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CDC Surveillance Summaries

March 1990

Contents

Waterborne Disease Outbreaks, 1986-1988

Foodborne Disease Outbreaks, 5-Year Summary, 1983-1987

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History of CDC Surveillance Activities

CDC has been actively involved in disease-surveillance activities since the formulation of the Communicable Disease Center in 1946. The original scope of the National Surveillance Program included the study of malaria, murine typhus, smallpox, psittacosis, diphtheria, leprosy, and sylvatic plague. In 1954, a surveillance section was established within the Epidemiology Branch of CDC, primarily concerned with planning and conducting continuing surveillance and making periodic reports. Occurrences such as the Asian influenza pandemic and the discovery of Legionnaires' disease prompted the involvement of CDC in additional surveillance activities. Over the years the surveillance activities of CDC have expanded to include not only new areas in infectious disease but also programs in human reproduction, injuries, environmental health, chronic disease, risk reduction, and occupational safety and health. Ongoing evaluation of these programs has led to new methods of data collection and analysis and has prompted examination of how data are disseminated to the public health community.

The publication titled *CDC Surveillance Summaries* was initiated in 1982 after a survey was made of CDC staff and state epidemiologists. Results of the survey suggested that improved coordination of surveillance reports with the *MMWR* and the *MMWR Annual Summary* (later titled *Summary of Notifiable Diseases, United States*) would facilitate timely publication; provide greater uniformity in the acquisition, evaluation, and reporting of surveillance data; and encourage the use of these data.

In 1985, the CDC Surveillance Coordination Group was formed with representatives from all Centers/Institute/Program Offices and from the Council of State and Territorial Epidemiologists. The Group was charged with developing and implementing a policy for CDC's public health surveillance activities. State public health officials also actively participate in the activities of the Group. These activities, which are documented in regular reports, are directed toward achieving the following goals: 1) conducting epidemiologic surveillance of all health events considered to be of high priority, 2) evaluating regularly all CDC surveillance activities, 3) developing and evaluating improved methods for the collection, analysis, and dissemination of surveillance data, and 4) maintaining and improving the expertise of CDC staff and constituents in the development, implementation, and evaluation of systems of public health surveillance.

Data Sources

Data on the reported occurrence of notifiable diseases are derived from reports supplied by the state and territorial health departments and by CDC program activities. These data are published weekly in the *MMWR*, and the final official numbers of cases are published in the annual *Summary of Notifiable Diseases*. Complementary data are provided in *MMWR* surveillance summaries and recommendations and reports. Data reported in the weekly *MMWR* and the more detailed data reported by individual CDC programs are collected independently; therefore, some numbers may be slightly different because of the timing of reports or because of refinements in case definition.

Data published in the *MMWR* series of publications should be interpreted with caution. Some diseases that cause severe clinical illness and are associated with serious consequences are probably reported quite accurately; however, diseases that are clinically mild and infrequently associated with serious consequences are less likely to be reported. Additionally, subclinical cases are seldom detected except in the course of epidemic investigations or special studies. The degree of completeness of reporting is also influenced by the diagnostic facilities available, the control measures in effect, and the interests and priorities of state and local officials responsible for disease control and surveillance. Finally, factors such as the introduction of new diagnostic tests and the discovery of new disease entities may cause changes in disease reporting independent of the true incidence of disease. Despite these limitations, the data in these reports have proven to be very useful in the analysis of trends.

CDC Surveillance Reports in the *MMWR* Series of Publications

Subject	Responsible Organizational Unit	Most Recent Report Published in MMWR Series
Abortion	CCDPHP*	1989; Vol. 38, No. SS-2
Acquired Immunodeficiency Syndrome (See AIDS)		
AIDS, Distribution by Racial/Ethnic Group	CID	1988; Vol. 37, No. SS-3
Behavioral Risk Factors	CCDPHP	1984; Vol. 33, No. 1SS
Birth Defects (see also Malformation)	CEHIC	1983; Vol. 32, No. 1SS
Campylobacter	CID	1988; Vol. 37, No. SS-2
Coal Workers' Health (see also Mining)	NIOSH	1985; Vol. 34, No. 1SS
Congenital Malformations, Minority Groups	CEHIC	1988; Vol. 37, No. SS-3
Dengue	CID	1985; Vol. 34, No. 2SS
Dental Caries and Periodontal Disease Among Mexican-American Children	CPS	1988; Vol. 37, No. SS-3
Ectopic Pregnancy	CCDPHP	1989; Vol. 38, No. SS-2
Ectopic Pregnancy, Mortality	CCDPHP	1987; Vol. 36, No. SS-2
Endometrial and Ovarian Cancers	EPO, CCDPHP	1986; Vol. 35, No. 2SS
Foodborne Disease	CID	1990; Vol. 39, No. SS-1
Gonococcal Infection	CPS, CID	1984; Vol. 33, No. 4SS
Gonorrhea and Salpingitis, Teenagers	CPS, CID	1983; Vol. 32, No. 3SS
Hepatitis	CID	1985; Vol. 34, No. 1SS
Hepatitis, Viral	CID	1983; Vol. 32, No. 2SS
Homicide	CCDPHP	1983; Vol. 32, No. 2SS
Homicides, Black Males	CEHIC	1988; Vol. 37, No. SS-1
Hysterectomy	CCDPHP	1986; Vol. 35, No. 1SS
Infant (see National Infant Mortality)		
Injury		
Death Rates, Blacks and Whites	CEHIC	1988; Vol. 37, No. SS-3
Drownings	CEHIC	1988; Vol. 37, No. SS-1
Falls, Deaths	CEHIC	1988; Vol. 37, No. SS-1
Firearm-Related Deaths, Unintentional	CEHIC	1988; Vol. 37, No. SS-1
In the Home, Persons Under 15 Years of Age	CEHIC	1988; Vol. 37, No. SS-1
Motor Vehicle-Related Deaths	CEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, State and Local	CEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, National	CEHIC	1988; Vol. 37, No. SS-1
Residential Fires, Deaths	CEHIC	1988; Vol. 37, No. SS-1
Tap Water Scalds	CEHIC	1988; Vol. 37, No. SS-1
Malaria, Imported	CID	1983; Vol. 32, No. 3SS
Malformations (see also Birth Defects)	CEHIC	1985; Vol. 34, No. 2SS
Maternal Mortality	CCDPHP	1988, Vol. 37, No. SS-5
Mining (see also Coal Workers' Health)	NIOSH	1986; Vol. 35, No. 2SS
National Infant Mortality	CCDPHP	1989; Vol. 38, No. SS-3
Nosocomial Infection	CID	1986; Vol. 35, No. 1SS
Occupational Injuries/Disease		
Among Loggers	NIOSH	1983; Vol. 32, No. 3SS
Hazards, Occupational	NIOSH	1985; Vol. 34, No. 2SS
In Meatpacking Industry	NIOSH	1985; Vol. 34, No. 1SS
State Activities	NIOSH	1987; Vol. 36, No. SS-2
Treated in Hospital Emergency Rooms	NIOSH	1983; Vol. 32, No. 2SS
Ovarian Cancer (see Endometrial and Ovarian Cancer)		
Pediatric Nutrition	CCDPHP	1983; Vol. 32, No. 4SS

*All abbreviations are listed at end of inventory.

CDC Surveillance Reports in the *MMWR* Series of Publications — Continued

Subject	Responsible Organizational Unit	Most Recent Report Published in MMWR Series
Pelvic Inflammatory Disease	CPS	1983; Vol. 32, No. 4SS
Plague	CID	1985; Vol. 34, No. 2SS
Plague, American Indians	CID	1988; Vol. 37, No. SS-3
Pneumoconiosis, Coal Miners	NIOSH	1983; Vol. 32, No. 1SS
Pregnancy, Teenage	CCDPHP	1987; Vol. 36, No. 1SS
Psittacosis	CID	1983; Vol. 32, No. 1SS
Rabies	CID	1989; Vol. 38, No. SS-1
Reye Syndrome	CID	1984; Vol. 33, No. 3SS
Rocky Mountain Spotted Fever	CID	1984; Vol. 33, No. 3SS
Rubella and Congenital Rubella	CPS	1984; Vol. 33, No. 4SS
Salmonella	CID	1988; Vol. 37, No. SS-2
Salpingitis (see Gonorrhea and Salpingitis)		
Sudden Unexplained Death Syndrome Among Southeast Asian Refugees	CEHIC, CPS	1987, Vol. 36, No. 1SS
Suicides, Persons 15-24 Years of Age	CEHIC	1988; Vol. 37, No. SS-1
Summer Mortality	CEH	1983; Vol. 32, No. 1SS
Toxic-Shock Syndrome	CID	1984; Vol. 33, No. 3SS
Trichinosis	CID	1988; Vol. 37, No. SS-5
Tubal Sterilization Among Women	CCDPHP	1983; Vol. 32, No. 3SS
Water-Related Disease	CID	1990; Vol. 39, No. SS-1

Abbreviations

CCDPHP	Center for Chronic Disease Prevention and Health Promotion
CEHIC	Center for Environmental Health and Injury Control
CID	Center for Infectious Diseases
CPS	Center for Prevention Services
EPO	Epidemiology Program Office
NIOSH	National Institute for Occupational Safety and Health

Waterborne Disease Outbreaks, 1986-1988

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Summary

From 1986 to 1988, 24 states and Puerto Rico reported 50 outbreaks of illness due to water that people intended to drink, affecting 25,846 persons. The protozoal parasite Giardia lamblia *was the agent most commonly implicated in outbreaks, as it has been for the last 10 years; many of these outbreaks were associated with ingestion of chlorinated but unfiltered surface water.* Shigella sonnei *was the most commonly implicated bacterial pathogen; in outbreaks caused by this pathogen, water supplies were found to be contaminated with human waste.* Cryptosporidium *contamination of a chlorinated, filtered public water supply caused the largest outbreak during this period, affecting an estimated 13,000 persons. A large multistate outbreak caused by commercially produced ice made from contaminated well water caused illness with Norwalk-like virus among an estimated 5,000 persons. The first reported outbreak of chronic diarrhea of unknown cause associated with drinking untreated well water occurred in 1987. Twenty-six outbreaks due to recreational water use were also reported, including outbreaks of* Pseudomonas *dermatitis associated with the use of hot tubs or whirlpools, and swimming-associated shigellosis, giardiasis, and viral illness. Although the total number of reported water-related outbreaks has been declining in recent years, the few large outbreaks due to* Cryptosporidium, *Norwalk-like agent,* Shigella sonnei, *and* Giardia lamblia *caused more cases of illness in 1987 than have been reported to the Water-Related Disease Outbreak Surveillance System for any other year since CDC and the Environmental Protection Agency began tabulating these data in 1971.*

INTRODUCTION

Since 1971, CDC—in collaboration with the Environmental Protection Agency (EPA)—has tabulated data on waterborne-disease outbreaks separately from those for foodborne-disease outbreaks and has compiled these data in annual surveillance reports. The Water-Related Diseases Activity has the following goals: 1) to determine trends in the incidence of water-related diseases in the United States, 2) to characterize the epidemiology of water-related diseases, 3) to disseminate information on prevention and control of water-related diseases to appropriate public health personnel, 4) to train personnel in federal, state, and local health departments in epidemiologic techniques used in the investigation of water-related disease outbreaks, and 5) to collaborate with local, state, and other federal and international agencies in initiatives concerning the prevention of water-related diseases.

In addition to outbreaks associated with water intended for drinking, the Water-Related Disease Surveillance Report cites reports of 1) outbreaks of illness associated with exposure to recreational water and 2) epidemiologic investigation of outbreaks of gastroenteritis on ocean-going passenger vessels that call on U.S. ports.

METHODS

Definition of Terms

A waterborne disease outbreak is an incident in which 1) two or more persons experience a similar illness after consumption or use of water intended for drinking and 2) epidemiologic evidence implicates the water as the source of illness. In addition, a single case of chemical poisoning constitutes an outbreak if laboratory studies indicate that the water has been contaminated by the chemical. Only outbreaks associated with water intended for drinking are included.

Community public water systems (municipal systems) are defined as public or investor-owned water systems that serve large or small communities, subdivisions, or trailer parks with at least 15 service connections or 25 year-round residents. Noncommunity public water systems (semipublic water systems) are those of institutions, industries, camps, parks, hotels, or service stations that may be used by the general public. Individual systems (private water systems), which are generally wells and springs, are those used by one or several residences or by persons traveling outside populated areas. These definitions correspond to those in the Safe Drinking Water Act (Public Law 93-523) of 1974.

Disease outbreaks associated with water used for recreational purposes meet the same criteria used for waterborne outbreaks associated with drinking water. However, outbreaks associated with recreational water involve exposure to or unintentional ingestion of fresh or marine water, but they exclude wound infections caused by water-related organisms.

Sources of Data

State health departments report water-related disease outbreaks to CDC on a standard reporting form. In addition, the Health Effects Research Laboratory of EPA contacts all state water-supply agencies annually to obtain information about waterborne disease outbreaks. This report includes information from both sources. Representatives from CDC and EPA review and summarize outbreak data and also work together to investigate and evaluate waterborne disease outbreaks. Also, on request by state health departments, CDC and EPA offer epidemiologic assistance, provide consultation in the engineering and environmental aspects of water treatment, and, when indicated, collect large-volume water samples to identify viruses, parasites, and bacterial pathogens.

In an effort to increase reporting, CDC sent a letter in January 1989 to all state and territorial epidemiologists and laboratory directors requesting any additional reports of outbreaks investigated during the 3-year period 1986 to 1988. States not responding or reporting any outbreak during this period were contacted again by telephone.

Vessel masters of passenger cruise ships must report all persons who visited the ship's physician because of diarrheal illness during each voyage as a part of their request for permission to enter a port. If ≥3% of passengers visit the ship's physician

with gastrointestinal illness on a 1-week voyage, a quarantine officer will board and inspect the ship, and an epidemiologic investigation may be conducted.

Interpretation of the data

Data in this report should be interpreted with caution. The number of waterborne disease outbreaks reported to CDC and EPA represents a fraction of the total number that occur. Since investigations were sometimes incomplete or conducted long after the outbreak, the quality of epidemiologic evidence implicating water varied; however, the waterborne hypothesis was the most logical explanation in these outbreaks. The likelihood of an outbreak's coming to the attention of health authorities varies considerably from one locale to another and depends largely upon consumer awareness, physician interest, and disease surveillance activities of state and local health and environmental agencies. Large interstate outbreaks and outbreaks of serious illness are most likely to come to the attention of health authorities. The quality of investigation conducted by state or local health departments varies considerably according to the department's interest in waterborne diseases and its budgetary, investigative, and laboratory resources. Additionally, a few outbreaks involving large numbers of persons may vastly alter the relative proportion of cases attributed to various etiologic agents. Therefore, this report should not be used to draw firm conclusions about the true incidence of waterborne disease outbreaks, or about the relative incidence of waterborne diseases of various etiologies.

RESULTS

For the 3-year period 1986-1988, state and local health departments reported 50 outbreaks due to water that people intended to drink, causing illness in 25,846 persons. Twenty-two outbreaks were reported in 1986, 15 in 1987, and 13 in 1988. The individual outbreaks are listed by year in Tables 1-3. Each outbreak is summarized by agent and type of water system (Table 4). Outbreaks occurred in all months except December; 26% occurred in July (Figure 1).

Each of 24 states and Puerto Rico reported at least one outbreak during this period. Thirty-four percent of outbreaks were reported from three states: Pennsylvania (7), Colorado (6), and Vermont (4).

Giardia lamblia was identified as the causative agent in nine (18%) outbreaks, eight of which were associated with deficiencies in community water systems. Six of these outbreaks were associated with unfiltered surface water systems in which the only treatment was chlorination. The largest *Giardia* outbreak reported to CDC affected >500 people; increased turbidity of the water and improper operation of the chlorinator may have contributed. *Cryptosporidium* in a chlorinated and filtered water supply caused one large parasitic disease outbreak (*1*). *Shigella sonnei* was the most common bacterial agent, implicated in four outbreaks. The largest of these was associated with contamination of a reservoir after heavy rains and loss of electricity. Thirty persons were hospitalized among the estimated 1,800 who became ill. One outbreak of gastroenteritis due to *Salmonella newport* and other species of *Salmonella* was caused by improper placement of a sewer line, possibly contaminating untreated well water. Another *Salmonella*-related outbreak was caused by ingestion of water from a storage tank that had possibly been contaminated by irrigation water; the one patient's isolate serotyped was identified as *S. dublin*. One *Campylobacter*-related outbreak occurred and was possibly caused by contamination of water mains

through a cross-connection. Norwalk-like viral agents were detected serologically or by identification of Norwalk antigen in stool in three outbreaks (*2,3*). In 24 of the 50 outbreaks, the etiology of acute gastrointestinal illness (AGI) could not be determined. Also reported was an outbreak of chronic gastrointestinal illness (CGI) of unknown etiology; the outbreak was associated with drinking untreated ground water at a rural restaurant (*4*).

The 1987 listing includes one multistate outbreak of Norwalk-like viral gastroenteritis due to contaminated ice (*2*). At least four clusters of illness were traced to ice produced by a manufacturer in Pennsylvania, including illness following a university football game in Pennsylvania, a museum fund-raising event in Delaware, and at least two catered events. Water used to make the ice originated in wells that had been flooded by a creek during heavy rains in early September; high concentrations of fecal coliforms were found in both the ice and well water. The ice (60-300 tons), produced the week after the flood and distributed to Pennsylvania, Delaware, and New Jersey, may have caused illness in >5,000 people; this estimate is based on distribution records and on the attack rates found in the Pennsylvania investigations. Residents with private wells flooded by the same creek were also thought to have been affected. The manufacturer recalled the remaining ice.

Five outbreaks were attributed to chemical intoxications. One was caused by back-siphoning of sodium hydroxide into a public water supply. Patients seen in emergency rooms had mouth ulcers, dermatitis, and first-degree skin burns. At several homes, the tap water had a pH of 12. Another outbreak due to an alkaline community water supply (pH 8.5-11) caused malaise, headaches, and dry, cracking, pruritic skin. Large amounts of soda ash and lime had been used to soften the water, without subsequent adjustment of the pH. Hyperfluoridation of a water supply resulted in illness characterized by nausea, vomiting, diarrhea, abdominal cramps, and pruritus. The pH of the water was 3.1, and copper levels were elevated because of the effects of acidity on the copper pipes. Ethylene-glycol contamination of a public water supply due to a cross-connection with a heating system also caused an outbreak (*5*). Symptoms included excessive fatigue, sleepiness, unsteadiness when walking, and dizziness. Water from the spigot had an ethylene-glycol concentration of 9%. One fatal case of methemoglobinemia was reported, involving an infant who was fed powdered formula; the formula had been prepared with well water contaminated with nitrates (*6*).

Pathogens reportedly were isolated from water samples during the investigation of five outbreaks: *Giardia* cysts in three, *Cryptosporidium* oocysts in one, and *Salmonella* in one. Coliform organisms were detected during the investigation of water systems in 32 outbreaks; in four outbreaks, coliforms were not detected. In the remaining investigations of outbreaks, no information was reported concerning testing of water for coliforms.

Most reported outbreaks were associated with community and noncommunity public water systems, as has been the case for most years since 1971 (Table 5). Deficiencies in water treatment were identified in 23 (46%) outbreaks, and untreated ground water was implicated in 16 (32%) (Table 6). Well water was the most common source of outbreaks, accounting for 28 (56%) over the 3-year period.

Data on 26 outbreaks associated with recreational water use for the period 1986-1988 are shown in Table 7. The most common illness was *Pseudomonas* dermatitis; all 10 of these outbreaks were associated with use of whirlpools or hot

tubs. The two outbreaks of giardiasis were associated with swimming in pools; three outbreaks of shigellosis affected persons swimming in lakes; and one outbreak in which a Norwalk-like agent was confirmed also affected persons swimming in a lake. Four other swimming-related outbreaks of AGI were of unknown etiology. One outbreak of aseptic meningitis involved four persons who swam in a family pool filled with unchlorinated water from a nearby creek. An outbreak of a febrile enterovirus-like illness was associated with swimming in an inadequately chlorinated wading pool (*7*). Pontiac fever affected 14 persons who had used a hotel whirlpool; symptoms were fever, shortness of breath, chest pain, myalgia, and joint pain. Six of eight patients tested had elevated antibodies to *Legionella pneumophila* serogroup 6. An outbreak of leptospirosis among persons swimming in a stream was reported from Hawaii.

Since the previous surveillance summary was published (1988) (*8*), we have obtained 10 additional reports from previous years: one from 1983, two from 1984, and seven from 1985. One of the 10 was associated with recreational water use. These outbreaks are included in Table 8, and those associated with water used for drinking are included in Table 5.

From 1986 to 1988, CDC personnel investigated 10 outbreaks of diarrheal illness on cruise ships calling on U.S. ports. Three were investigated in 1986, two in 1987, and five in 1988. The mean size of the outbreak was 323 passengers (range 112-477). One ship had outbreaks on two consecutive 1-week cruises (*9*). Norwalk-like agents were identified as the cause of two outbreaks. No specific pathogens were identified in the eight others, but many had features consistent with Norwalk-like viral illness. Two outbreaks were possibly associated with meals served on board; in one, a "marinated calamari and vegetable julienne" dish was suspect. The ship's water was the probable vehicle in one outbreak. Illness on two cruises was possibly caused by food or water consumed offshore.

DISCUSSION

The number of reported outbreaks associated with water intended for drinking was the same in 1986 as in the previous year, although the number was smaller in 1987 and 1988. The number of outbreaks reported in 1988 was the smallest ever reported to the Waterborne Outbreak Surveillance System. Additional outbreaks for these years may be reported to CDC after this summary is published.

The decrease in reported outbreaks may be due to an actual decrease in number of occurrences or to a decrease in the recognition or reporting of outbreaks. At the Workshop on Methods for Investigation of Waterborne Disease Outbreaks in Denver in October 1988, representatives from many state health departments, departments of natural and environmental resources, CDC, and EPA addressed this issue. The participants made recommendations to improve reporting; these recommendations include designating Waterborne Outbreak Surveillance Coordinators in each state, at CDC, and at EPA to assist with the gathering and reporting of data on waterborne outbreaks (*10-12*).

Despite the smaller number of outbreaks reported in recent years, some individual outbreaks were large. As a result, more cases of water-related illness were reported in 1987 than in any other year since CDC and EPA began tabulating these data in 1971. The number of cases reported in 1988 was also larger than in 3 of the 4 previous

years. Several large outbreaks due to *Cryptosporidium*, Norwalk-like viruses, *Shigella sonnei*, and *Giardia lamblia* are responsible for this reported increase in the total number of ill persons.

The cryptosporidiosis outbreak that occurred in Georgia in 1987 was the largest outbreak ever reported to the Waterborne Outbreak Surveillance system. An estimated 13,000 people became ill with gastroenteritis after consuming water from a filtered, chlorinated public water supply (*1*). *Cryptosporidium* oocysts were isolated from patients' stool specimens and from samples of treated public water. Unlike a previously reported cryptosporidiosis outbreak associated with intermittent contamination of a water supply (*13*), this water system met current state and federal drinking water standards. These standards may not be sufficient to prevent outbreaks due to this pathogen; the investigation showed that although treated water met turbidity standards, filters allowed passage of particulate matter likely accompanied by oocysts. Recommended improvements in chemical flocculation and filtration practices resulted in clearance of oocysts from the water.

The outbreak of Norwalk-like viral gastroenteritis associated with commercially manufactured ice in 1987 (*2*) demonstrates the potential for large outbreaks when a commercial product becomes contaminated; this potential applies to water and ice as well as to food. Production of commercial ice, like bottled water, is not consistently monitored by state or federal agencies.

Shigella sonnei was the bacterial agent most commonly associated with waterborne outbreaks for the period 1986-1988, causing four outbreaks with 2,733 persons ill. Each of the drinking water outbreaks was associated with deficiencies in water supplies, leading to contamination with human waste. Large outbreaks of shigellosis can lead to secondary transmission in day-care centers, temporary encampments, and other settings.

Giardia was the agent most commonly implicated in outbreaks, as it has been for the last 10 years. Filtration is necessary to remove *Giardia* from water; chlorination alone is insufficient without high concentrations and long contact times (*14,15*). To prevent waterborne transmission of *Giardia* and other infectious agents, EPA has prepared criteria for filtration and disinfection of all public water systems using surface-water sources (*16,17*).

The first reported outbreak of chronic diarrhea associated with drinking untreated well water occurred in 1987 (*4*). This outbreak was listed as CGI. Patients with CGI during this outbreak had diarrhea of unknown cause lasting ≥4 weeks. Examination of stools did not detect pathogenic viruses, bacteria, or parasites. Patients had clinical and pathologic characteristics similar to those of patients in an outbreak associated with drinking raw milk that occurred in Brainerd, Minnesota, in 1984 and 1985 (*18*); the term "Brainerd diarrhea" has been used to describe this illness. Because the disease can be debilitating and the cause is unknown, rapid identification, investigation, and control of outbreaks of chronic diarrhea are particularly important.

Outbreaks of AGI of unknown etiology accounted for 48% of all outbreaks reported. Incubation period, duration of illness, and symptoms for many of the outbreaks suggest that they were caused by 27-nanometer Norwalk-like viruses. In four outbreaks in which patients were culture-negative for common bacterial pathogens, fewer than 50% of the patients vomited, and the mean or median duration of illness was ≥4 days; these outbreaks may have been due to *Escherichia coli*. Increased

availability of testing for viral serology, detection of viral antigen in stool, and identification of *E. coli* toxins would aid in determining the causes of these outbreaks.

Swimming-associated outbreaks due to *Shigella, Giardia,* Norwalk-like viruses, and other enteroviruses continue to occur; outbreaks due to unintentional ingestion of these pathogens during swimming have now been well documented (*7,19-26*). Provision of temporary toilet facilities to adequately serve summer crowds is the single measure most likely to prevent such outbreaks. EPA has published guidelines for evaluating the quality of recreational waters (*27,28*).

Outbreaks of *Pseudomonas* dermatitis associated with use of hot tubs, whirlpool baths, and swimming pools are preventable if the water is maintained at a pH of 7.2-7.8 with free residual chlorine levels of at least 1.0 mg/L (*29*). Pontiac fever due to aerosolized antigens of *Legionella pneumophila* is another risk of whirlpool use (*30,31*). CDC health and safety guidelines for public spas and hot tubs are available (*32*).

Large outbreaks aboard passenger cruise ships continue to occur, although less often than in the past, demonstrating the importance of diarrheal disease surveillance and the Vessel Sanitation Program (*33,34*).

Illnesses reported by the Waterborne Outbreak Surveillance System probably represent only a small proportion of all illness associated with waterborne-disease agents, not only because of underreporting, but also because many sporadic cases occur. An association of sporadic cases of giardiasis with use of unfiltered municipal or nonmunicipal water has been demonstrated (*35*), as has an association of sporadic cryptosporidiosis with ingestion of untreated surface water (*36*). Illnesses occurring after years of chronic exposure to low-level toxins are not detectable by this system, nor are outbreaks or sporadic illnesses due to opportunistic pathogens that may be widespread in chlorinated water systems but may cause illness with insidious onset and long incubation periods in persons who are immunocompromised (*37,38*).

Despite these limitations, the data summarize reported waterborne disease outbreaks, identifying disease agents, types of water systems involved, and associated deficiencies. Monitoring these patterns is important because new diseases, such as cryptosporidiosis and Brainerd chronic diarrhea, can emerge, possibly requiring new means of control. Maintaining the capabilities of local and state health departments to investigate outbreaks and to identify their causes remains important in controlling and preventing outbreaks of waterborne disease.

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TABLE 1. Waterborne disease outbreaks, United States, 1986*

State	Month	Etiologic agent†	No. cases	Type of system§	Deficiency¶	Location of outbreak	Source
AL	Jul.	*Shigella sonnei*	25	Com	2	Trailer Park	
AL	Oct.	Sodium hydroxide	11	Com	4		
CA	Apr.	*Giardia*	127	Com	4	Corrections facility	
CO	Jun.	AGI	90	NC	2	Camp	Well
CO	Aug.	*Giardia*	23	NC	3	Resort	Well
CT	Mar.	Flouride-copper	52	Com	3	Community	
ME	Nov.	*Giardia*	12	Com	3	Community	River
MS	Aug.	*Salmonella*, mixed	9	Com	2	Community	Well
NM	Jun.	AGI	36	NC	3	Resort	River
NM	Jun.	AGI	233	NC	3	Camp	Spring
NY	Nov.	*Giardia*	44	Com	3	Community	Lake
OK	May	*Campylobacter*	250	Com	4	Community	Lake
PA	Sep.	AGI	213	NC	3	Restaurant	Well
SD	Jun.	Nitrate	1	Ind	2	Farm	Well**
SD	Aug.	Norwalk	135	NC	3	Camp	Well
TX	Jul.	*Shigella sonnei*	8	Ind	2	Private home	Well
UT	Jun.	*Salmonella*	61	Com	4	Community	Well
VA	Jul.	AGI	110	NC	3	Camp	Well
VT	Jan.	*Giardia*	68	Com	3	Trailer Park	River
VT	Feb.	AGI	37	NC	3	Motel	Well
VT	Mar.	AGI	8	NC	3	Motel††	Well
WY	Jul.	AGI	16	NC	3	Camp	Infiltration gallery

*See Methods section for description of reporting variables.
†AGI = acute gastrointestinal illness of unknown etiology.
§Com = community (municipal); NC = noncommunity (semipublic); Ind = individual.
¶2 = untreated ground water, 3 = treatment deficiencies, 4 = distribution system deficiencies.
**Resulted in death.
††Same motel as above.

TABLE 2. Waterborne disease outbreaks, United States, 1987*

State	Month	Etiologic agent†	No. cases	Type of system§	Deficiency¶	Location of outbreak	Source
CT	Jul.	*Giardia*	120	Com	4	Community	Well
GA	Jan.	*Cryptosporidium*	13,000	Com	3	Community	River
IL	Jul.	CGI	72	NC	2	Restaurant	Well
ME	Sep.	AGI	9	NC	2	Resort	Well
ND	Apr.	Ethylene glycol	29	Com	4	Firehall	
NH	Jul.	AGI	71	NC	1	Camp	Lake
PA	Apr.	*Giardia*	513	Com	3	Community	River
PA	Jul.	AGI	53	NC	5	Resort	Well
PA	Aug	AGI	22	NC	2	Camp	Well
PA	Sep.	AGI	?	Ind	2	Individual homes	Wells
PR	Jul.	AGI	1,400	Com	3	Community	Lake
PR	Oct.	*Shigella sonnei*	1,800	Com	3	Community	Lake
VT	Jul.	AGI	21	Com	2	Trailer park	Well
WI	Mar.	AGI	39	Com	5	Restaurant	
**	Sep.	Norwalk-like	5,000	NC	3	Multiple	Well††

*See Methods section for description of reporting variables.
†AGI = acute gastrointestinal illness of unknown etiology; CGI = chronic gastrointestinal illness of unknown etiology.
§Com = community (municipal); NC = noncommunity (semipublic); Ind = individual.
¶1 = untreated surface water, 2 = untreated ground water, 3 = treatment deficiencies, 4 = distribution system deficiencies, 5 = miscellaneous.
**Multiple states: Pennsylvania, Delaware, New Jersey.
††Ice from contaminated well water.

TABLE 3. Waterborne disease outbreaks, United States, 1988*

State	Month	Etiologic agent†	No. cases	Type of system§	Deficiency¶	Location of outbreak	Source
CO	Feb.	*Giardia*	90	Com	3	Resort	River
CO	Apr.	Alkaline water	10	Com	3	Community	Lake
CO	Jul.	AGI	80	NC	3	Resort	Well
CO	Nov.	AGI	7	Com	1	Community	Stream
ID	Jun.	Norwalk-like	339	NC	2	Camp	Well
ME	Nov.	AGI	7	NC	2	Restaurant	Well
MO	Mar.	AGI	85	Ind	2	Private home	Well
MO	Aug.	AGI	30	NC	2	Golf course	Well
PA	Jul.	*Giardia*	172	Com	3	Community	Lake
PA	Sep.	AGI	26	NC	2	Camp	Well
SD	Jul.	AGI	42	NC	3	Hotel	Well
TX	May	*Shigella sonnei*	900	NC	3	Restaurant	Well
WI	May	AGI	340	NC	2	Restaurant	Well

*See Methods section for description of reporting variables.
†AGI = acute gastrointestinal illness of unknown etiology.
§Com = community (municipal); NC = noncommunity (semipublic); Ind = individual.
¶1 = untreated surface water, 2 = untreated ground water, 3 = treatment deficiencies.

TABLE 4. Waterborne disease outbreaks, by etiologic agent and type of water system, United States, 1986-1988

	Type of water system							
	Public				Individual		Total	
	Community		Noncommunity					
Agent	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases	Outbreaks	Cases
AGI*	4	1,467	18	1,423	2	85	24	2,975
Giardia	8	1,146	1	123	0	0	9	1,169
Chemical	4	102	0	0	1	1	5	103
Shigella	2	1,825	1	900	1	8	4	2,733
Norwalk	0	0	3	5,474	0	0	3	5,474
Salmonella	2	70	0	0	0	0	2	70
Campylobacter	1	250	0	0	0	0	1	250
Cryptosporidium	1	13,000	0	0	0	0	1	13,000
CGI	0	0	1	72	0	0	1	72
TOTAL	22	17,860	24	7,892	4	94	50	25,846

*AGI = acute gastrointestinal illness of unknown etiology; CGI = chronic gastrointestinal illness of unknown etiology.

TABLE 5. Waterborne disease outbreaks, by year and type of water supply system, United States, 1971-1988*

Year	Community	Noncommunity	Individual	Total	Total cases
1971	8	8	4	20	5,184
1972	9	19	2	30	1,650
1973	6	16	3	25	1,762
1974	11	9	5	25	8,356
1975	6	16	2	24	10,879
1976	9	23	3	35	5,068
1977	14	18	2	34	3,860
1978	10	19	3	32	11,435
1979	24	13	8	45	9,841
1980	26	20	7	53	20,045
1981	14	18	4	36	4,537
1982	26	15	3	44	3,588
1983	30	9	4	43	21,036
1984	12	5	10	27	1,800
1985	7	14	1	22	1,946
1986	10	10	2	22	1,569
1987	8	6	1	15	22,149
1988	4	8	1	13	2,128
TOTAL (%)	234 (43)	246 (45)	65 (12)	545	136,833

*See Methods section for description of reporting variables.

TABLE 6. Deficiencies leading to waterborne disease outbreaks, by type of water system involved and by type of deficiency, United States, 1986-1988

Type of deficiency	Type of water system: Public — Community Outbreaks	Public — Noncommunity Outbreaks	Individual — Outbreaks	Total
Untreated surface water	1	1	0	2
Untreated ground water	3	9	4	16
Treatment	11	12	0	23
Distribution system	6	0	0	6
Miscellaneous	1	2	0	3

TABLE 7. Disease outbreaks associated with recreational water use, United States, 1986-1988

Year	State	Month	Illness	No. Cases	Etiologic agent*	Location	Source
1986	AK	Aug.	Dermatitis	11	*Pseudomonas*	Spa	Hot tub, pool
1986	CA	May	Gastroenteritis	16	AGI	Municipal area	Pool
1986	CA	Aug.	Gastroenteritis	41	Norwalk-like	Recreation area	Lake
1986	MN	Mar.	Dermatitis	13	*Pseudomonas*	Municipal area	Whirlpool
1986	WI	Dec.	Dermatitis	9		Motel	Whirlpool
1986	WY	May	Dermatitis	36	*Pseudomonas*	Motel	Hot tub, pool
1987	CO	Jun.	Enterovirus-like	26		Recreation area	Pool
1987	HI	Jul.	Leptospirosis	8	*Leptospira*	Recreation area	Stream
1987	MD	Jun.	Gastroenteritis	266	*Giardia*	Municipal area	Pool
1987	MD	Jul.	Aseptic meningitis	4		Recreation area	Creek
1987	ME	Jan.	Dermatitis	41	*Pseudomonas*	Motel	Hot tub
1987	PA	Nov.	Dermatitis	22	*Pseudomonas*	Motel	Hot tub
1987	SC	Jun.	Gastroenteritis	130	*Shigella sonnei*	Recreation area	Lake
1987	VT	Mar.	Dermatitis	12	*Pseudomonas*	Resort	Whirlpool
1987	WA	Sep.	Dermatitis	4	*Pseudomonas*	Apt. complex	Hot tub
1987	WI	May	Dermatitis	10	*Pseudomonas*	Private home	Hot tub
1987	WI	Aug.	Gastroenteritis	160	AGI	Camp	Pond
1988	GA	Jun.	Gastroenteritis	22	*Shigella sonnei*	Recreation area	Lake
1988	MD	Jun.	Gastroenteritis	34	*Giardia*	Recreation area	Pool
1988	ME	Dec.	Dermatitis	6		Spa	Hot tub
1988	PA	Jul.	Gastroenteritis	138	*Shigella sonnei*	Recreation area	Lake
1988	VT	Jul.	Gastroenteritis	300	AGI	Recreation area	Lake
1988	VT	Jul.	Gastroenteritis	36	AGI	Swimming area	Lake
1988	WA	Mar.	Dermatitis	2	*Pseudomonas*	Private home	Hot tub
1988	WA	Jun.	Dermatitis	2	*Pseudomonas*	Private home	Hot tub
1988	WI	Jun.	Pontiac fever	14	*Legionella*	Motel	Whirlpool

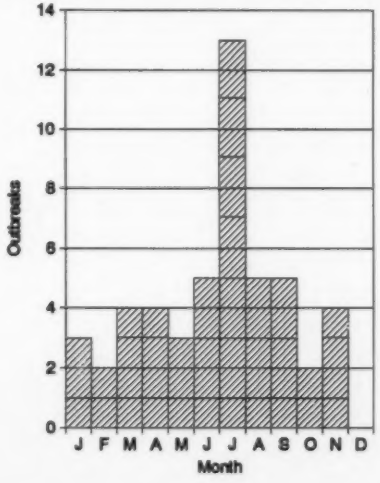
*AGI = acute gastrointestinal illness of unknown etiology.

TABLE 8. Waterborne disease outbreaks not included in previous summaries, United States, 1983-1985*

Year	State	Month	Etiologic agent†	No. cases	Type of system§	Deficiency¶	Location of outbreak	Source
1983	NM	Jun.	AGI	113	NC	2	Camp	Spring
1984	NY	Jan.	AGI	24	Ind	5	Restaurant	Ice
1984	NY	Sep.	AGI	34	Ind	5	Private party	Ice
1985	AR	Mar.	*Campylobacter jejuni*	24	NC	2	Camp	Spring
1985	CA	Sep.	*Shigella sonnei & boydii*	68	Rec	5	Recreation area	Lake
1985	NY	Mar.	Ethylene glycol	1	Com	4	Hospital	Hemodialysis**
1985	NY	Jun.	AGI	4	NC	2	Restaurant	Well
1985	PA	May	AGI	70	NC	3	Restaurant	Well
1985	PA	Sep.	AGI	275	NC	2	School	Well
1985	PA	Nov.	AGI	11	NC	3	Restaurant	Well

*See Methods section for description of reporting variables.
†AGI = acute gastrointestinal illness of unknown etiology.
§Com = community (municipal); NC = noncommunity (semipublic); Ind = individual; Rec = recreational.
¶2 = untreated ground water, 3 = treatment deficiencies, 4 = distribution system deficiencies, 5 = miscellaneous.
**Resulted in death.

FIGURE 1. Waterborne disease outbreaks, by month, United States, 1986-1988



Foodborne Disease Outbreaks, 5-Year Summary, 1983-1987

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Summary

This report summarizes data from foodborne disease outbreaks reported to CDC from 1983 through 1987. With a few exceptions, an outbreak is defined as an incident in which two or more persons experience a similar illness and food is implicated. During this period, 2,397 outbreaks of foodborne disease were reported, representing 91,678 cases. Among outbreaks in which the etiology was determined, bacterial pathogens caused the largest number of outbreaks (66%) and cases (92%). Chemical agents caused 26% of outbreaks and 2% of cases. Parasites caused 4% of outbreaks and <1% of cases, and viruses caused 5% of outbreaks and 5% of cases. The discrepancies between the number of outbreaks and the number of cases attributed to each etiologic agent emphasizes the importance of evaluating both numbers before drawing conclusions. The etiologic agent was not determined in 62% of outbreaks, reflecting the need for improved investigative skills. The number of outbreaks reported by this surveillance system is only a small fracton of the true number that occur. The likelihood of an outbreak's being reported depends on many factors, such as ease of recognition and ease of laboratory confirmation. Sporadic foodborne illness is far more common and is not included in this report.

INTRODUCTION

The reporting of foodborne and waterborne diseases in the United States began over half a century ago when state and territorial health officers, concerned about the high morbidity and mortality caused by typhoid fever and infantile diarrhea, recommended that cases of enteric fever be investigated and reported. The purpose was to obtain information about the role of food, milk, and water in outbreaks of intestinal illness as the basis for public health action. Beginning in 1923, the Public Health Service published summaries of outbreaks of gastrointestinal illness attributed to milk. In 1938, it added summaries of outbreaks caused by all foods. These early surveillance efforts led to the enactment of important public health measures that had a profound influence in decreasing the incidence of enteric diseases, particularly those transmitted by milk and water.

From 1951 through 1960, the National Office of Vital Statistics reviewed reports of outbreaks of foodborne illness and published summaries of them annually in *Public Health Reports*. In 1961, CDC—then the Communicable Disease Center—assumed responsibility for publishing reports on foodborne illness. For the period 1961-1965, CDC discontinued publication of annual reviews but reported pertinent statistics and detailed individual investigations in the *MMWR*.

In 1966, the present system of surveillance of foodborne and waterborne diseases began with the incorporation of all reports of enteric disease outbreaks attributed to microbial or chemical contamination of food or water into an annual summary. Since 1966, the quality of investigative reports has improved, primarily as a result of more active participation by state and federal agencies in the investigation of foodborne and waterborne disease outbreaks. Because of increasing interest and activity in waterborne disease surveillance, foodborne and waterborne disease outbreaks were reported in separate annual summaries in the period 1978-1982. This report summarizes data from foodborne disease outbreaks reported to CDC from 1983 through 1987.

Foodborne disease surveillance has traditionally served three objectives:

1. **Disease Prevention and Control.** Early identification and removal of contaminated products from the commercial market, correction of faulty food-preparation practices in food-service establishments and in the home, and identification and appropriate treatment of human carriers of foodborne pathogens are the main prevention and control measures that result from surveillance of foodborne disease.
2. **Knowledge of Disease Causation.** The responsible pathogen was not identified in over half of the foodborne disease outbreaks reported to CDC between 1983 and 1987; this proportion is similar to that of earlier years. In many of these outbreaks, pathogens known to cause foodborne illness may not have been identified because laboratory investigations were late or incomplete. In others, the responsible pathogen may have escaped detection even after a thorough laboratory investigation, either because the pathogen may not have been recognized as a cause of foodborne disease or because the pathogen could not be identified by available laboratory techniques. When more thorough clinical, epidemiologic, and laboratory investigations are conducted, perhaps many of these pathogens can be identified, and suitable measures for prevention and control can be instituted.
3. **Administrative Guidance.** The collection of data from investigations of foodborne disease outbreaks permits the assessment of trends in the prevalence of etiologic agents and in vehicles of disease transmission. In addition, it brings to light common errors in food handling. The compilation and publishing of annual data enable local and state health departments and others involved in the implementation of food protection programs to be kept informed of the factors involved in foodborne disease outbreaks. Comprehensive surveillance should result in a greater awareness of the most important food protection methods, the institution of better training programs, and more effective use of available resources.

METHODS

Definition of Outbreak

For the purpose of this report, a foodborne disease outbreak is defined as an incident in which 1) two or more persons experience a similar illness after ingestion of a common food, and 2) epidemiologic analysis implicates the food as the source of the illness. A few exceptions exist; for example, one case of botulism or chemical poisoning constitutes an outbreak.

Outbreaks of known etiology are those for which laboratory evidence of a specific agent is obtained and specified criteria are met. Outbreaks of unknown etiology are those for which epidemiologic evidence implicates a food source, but adequate laboratory confirmation is not obtained. Outbreaks of unknown etiology are subdivided into four subgroups by incubation period of the illnesses: <1 hour (probable chemical poisoning), 1-7 hours (probable *Staphylococcus* food poisoning), 8-14 hours (probable *Clostridium perfringens* food poisoning), and >14 hours (other infectious or toxic agents).

Source of Data

Outbreaks are reported to CDC on a standard reporting form. Reports come most frequently from state and local health departments; they may also be received from federal agencies such as the Food and Drug Administration (FDA), the U.S. Department of Agriculture (USDA), the U.S. Armed Forces, and occasionally from private physicians. Forms are reviewed at CDC to determine whether a specific etiologic agent or vehicle for the outbreak can be confirmed. In some instances, questions about an etiologic agent may be referred back to the reporting agency; otherwise, data are accepted as reported on the forms.

Interpretation of Data

The limitations on the quantity and quality of data presented here must be recognized in order to avoid misinterpretation. The number of outbreaks of foodborne disease reported by this surveillance system clearly represents only a small fraction of the outbreaks that occur. The likelihood of an outbreak's coming to the attention of health authorities varies considerably depending on consumers' and physicians' awareness, their interest, disease surveillance activities of state and local health and environmental agencies, and their motivation to report the incident. For example, large outbreaks; interstate outbreaks; restaurant-associated outbreaks; and outbreaks involving serious illness, hospitalizations, or deaths are more likely to come to the attention of health authorities than cases of mild illness after a family cookout.

The quality of the data presented here depends upon the commitment to surveillance of this type of disease by state or local health departments. A department's interest in foodborne disease and its investigative and laboratory capabilities are important determinants of the quality of the investigation. Furthermore, the likelihood that the findings of the investigation will be reported varies from one locality to another. This report, then, should not be the basis of firm conclusions about the absolute incidence of foodborne disease, nor should it be used to draw conclusions about the relative incidence of foodborne diseases by specific causes. For example, foodborne diseases characterized by short incubation periods, such as those caused by a chemical agent or staphylococcal enterotoxin, are more likely to be recognized as common-source foodborne disease outbreaks than those diseases with longer incubation periods, such as hepatitis A. Outbreaks involving less common pathogens, such as *Bacillus cereus*, *Escherichia coli*, or *Giardia lamblia* are less likely to be confirmed because these organisms are often not considered in clinical, epidemiologic, and laboratory investigations of foodborne disease outbreaks. Also, pathogens that generally cause mild illness will be underrepresented, whereas those causing

serious illness, such as *Clostridium botulinum*, are more likely to be identified. Similarly, outbreaks associated with restaurants or commercial products have a higher likelihood of being reported.

The categorization of food vehicles can be a source of confusion. Many foods contain a variety of ingredients, yet each food vehicle of transmission is listed under only one food-vehicle category. For example, homemade ice cream made with milk and eggs is listed under "ice cream" rather than under "milk" or "eggs." The category "Mexican food" includes vehicles made with beef, cheese, lettuce, and other ingredients. The reported number of outbreaks attributed to one food-vehicle category often does not include all outbreaks due to a particular ingredient in that food.

The outbreak data reported here represent only a small and selected fraction of foodborne illness in the country. Outbreaks produced by different agents vary considerably in size. In assessing the magnitude of the problem due to any food vehicle or pathogen, one should examine the number of cases involved in the outbreaks as well as the number of outbreaks. In addition, sporadic cases of foodborne illness are far more common than cases associated with outbreaks. With the exception of botulism and a few chemical exposure diseases, sporadic cases are not reported to this surveillance system.

RESULTS

The results are presented by subject and etiologic agent for each of the five years, as follows: outbreaks, cases, and deaths (Tables 1-5), vehicles of transmission (Tables 6-10), place where food was eaten (Tables 11-15), month of occurrence (Tables 16-20), and contributing factors (Tables 21-25).

1983

In 1983, 505 outbreaks (14,898 cases) of foodborne diseases were reported to CDC. Reports were received from 39 states as well as from the District of Columbia and Guam (Figure 1). New York reported the largest number of outbreaks (174), with 80 from New York City; Washington reported the next largest number (38), followed by California (30), Hawaii (23), and Massachusetts (23). The etiologic agent was confirmed in 187 (37%) of the 505 outbreaks (Table 1).

Bacterial pathogens accounted for 127 outbreaks (7,082 cases). *Salmonella* caused most of the bacterial foodborne disease outbreaks (72 outbreaks, 2,427 cases), followed by *Staphylococcus aureus* (14 outbreaks, 1,257 cases), and *C. botulinum* (13 outbreaks, 46 cases). An outbreak of illness due to *Listeria monocytogenes* was associated with consumption of one brand of pasteurized milk in New England. Forty-two immunosuppressed adults and seven fetuses or newborns accounted for the 49 cases in Massachusetts. Fourteen (29%) cases were fatal. An outbreak of *Brucella melitensis* infections due to unpasteurized goat cheese occurred in Texas. All 29 persons affected were Mexican immigrants; 14 were hospitalized, and one person died. The cheese was reportedly produced in Mexico and was purchased from unlicensed vendors who sold it from their cars. A large outbreak of *Shigella dysenteriae* type 2 infections occurred among persons who ate at a Maryland hospital cafeteria; 1,502 persons were ill, and 24 were hospitalized. Illness was associated with consumption of raw vegetables at a cafeteria salad bar.

Chemical agents caused 45 outbreaks (264 cases): ciguatoxin caused 13 outbreaks (43 cases), and scombrotoxin caused 13 outbreaks (27 cases). All four parasitic disease outbreaks (eight cases) were due to *Trichinella spiralis*. Viral agents (10 hepatitis A outbreaks and one Norwalk virus outbreak) accounted for 550 cases. The Norwalk virus outbreak involved 20 persons and was associated with consumption of raw clams.

Thirty-five deaths from foodborne illness were reported: 18 from *L. monocytogenes*, seven from *Salmonella*, three from *Streptococcus*, three from *C. botulinum*, one from *Campylobacter jejuni*, one from hepatitis A, one from *Brucella*, and one from mushroom poisoning. Incubation periods were known for illnesses in 386 outbreaks. In 21 outbreaks, the incubation period was <1 hour; in 107, it was 1-7 hours; in 85, it was 8-14 hours; and in 173 outbreaks, it was ≥15 hours.

The food vehicle of transmission was determined in 74% of the 187 outbreaks in which a pathogen was identified (Table 6). Fish was the vehicle of transmission in 58% of the outbreaks of diseases caused by chemicals. Food eaten in a restaurant was associated with 47% of outbreaks, and food eaten at home, with 24% (Table 11). The proportion of foodborne illness due to known etiologic agents was highest in September (Table 16).

1984

In 1984, 543 outbreaks (16,420 cases) of foodborne disease were reported to CDC. Reports were received from 38 states as well as from the District of Columbia, Guam, and Puerto Rico (Figure 2). New York reported the largest number of outbreaks (162), with 46 from New York City; Washington reported the next largest number (43), followed by California (38) and Florida (34). The etiologic agent was confirmed in 185 (34%) of the 543 outbreaks (Table 2).

Bacterial pathogens accounted for 128 outbreaks (7,307 cases). *Salmonella* caused most of the bacterial foodborne disease outbreaks (78 outbreaks, 4,479 cases) followed by *S. aureus* (11 outbreaks, 1,153 cases), and *Clostridium perfringens* (eight outbreaks, 882 cases). An outbreak of *E. coli* 0157:H7 infection associated with hamburger occurred in a nursing home in Nebraska. This was the third reported foodborne outbreak due to this organism in the United States, the first two having occurred in 1982. Thirty-four persons were ill, 14 were hospitalized, and four died. An outbreak of *Salmonella typhimurium* infection affected over 700 persons in a small Oregon town. Most ill persons had eaten at a salad bar in one of 10 implicated restaurants; the salad bar had been deliberately contaminated. An outbreak of gastroenteritis due to enterotoxigenic *E. coli* involved 42 persons who ate Seafood Newburg in Maine.

Chemical agents caused 42 outbreaks (216 cases). All 11 parasitic disease outbreaks were caused by *T. spiralis* (60 cases). Three of these outbreaks were associated with consumption of bear meat. Viral agents caused four outbreaks (610 cases).

Twelve deaths from foodborne illness were reported: four from *E. coli*, three from *Salmonella*, two from *C. perfringens*, one from *Shigella*, one from consumption of water hemlock, and one from unknown etiology. Incubation periods were known for illnesses in 405 outbreaks. In 18 outbreaks, the incubation period was <1 hour; in 118, it was 1-7 hours; in 93, it was 8-14 hours; and in 176, it was ≥15 hours.

The food vehicle of transmission was determined in 70% of the 185 outbreaks in which a pathogen was identified (Table 7). Fish was the vehicle of transmission in

75% of the outbreaks of diseases caused by chemicals. Food eaten in a restaurant was associated with 44% of the outbreaks, and food eaten at home, with 25% (Table 12). The proportion of foodborne illness due to known etiologic agents was highest in August (Table 17).

1985

In 1985, 495 outbreaks (31,079 cases) of foodborne disease were reported to CDC. Reports were received from 45 states, as well as from the District of Columbia, the U.S. Virgin Islands, and Guam (Figure 3). New York reported the largest number of outbreaks (143), with 36 from New York City; Washington reported the next largest number (60), followed by Hawaii (36) and California (31). The etiologic agent was confirmed in 220 (44%) of the 495 outbreaks (Table 3).

Bacterial pathogens accounted for 143 outbreaks (22,132 cases). *Salmonella* caused most of the bacterial foodborne disease outbreaks (79 outbreaks, 19,660 cases), followed by *C. botulinum* (17 outbreaks, 33 cases) and *S. aureus* (14 outbreaks, 421 cases). The largest single foodborne outbreak ever reported to CDC was caused by *S. typhimurium* in 1985. The outbreak was associated with 2% low-fat pasteurized milk produced by a dairy plant in Chicago. The number of ill persons was estimated to be >150,000. There were >16,000 culture-confirmed cases, at least 2,777 persons hospitalized, and 14 deaths with which salmonellosis may have been associated. The use in the month before illness of antimicrobials to which the organism was resistant increased the risk of illness. A statewide outbreak of chloramphenicol-resistant *Salmonella newport* infection occurred in California. Illness was associated with ground beef eaten during the week before onset and with the use of penicillin or tetracycline during the month before onset. The epidemic strain was traced from humans back through hamburger meat processors and abattoirs to dairy farms where chloramphenicol was used. An outbreak of *L. monocytogenes* infections due to Mexican-style soft cheese was centered in California. Over 150 persons became ill, most of whom were pregnant women or their offspring; the fatality rate was 34%. Investigation of the implicated factory suggested that the cheese was commonly contaminated with unpasteurized milk.

Chemical agents caused 58 outbreaks (392 cases). Nine outbreaks (52 cases) were due to parasites. Viral agents caused 10 outbreaks (411 cases).

Seventy-six deaths from foodborne illness were reported: 52 from *L. monocytogenes*, 20 from *Salmonella*, two from *C. botulinum*, one from *T. spiralis*, and one from an unknown pathogen. Incubation periods were known for illnesses in 373 outbreaks. In 18 outbreaks, the incubation period was <1 hour; in 105, it was 1-7 hours; in 90, it was 8-14 hours, and in 160, it was ≥15 hours.

The food vehicle of transmission was determined in 75% of the 220 outbreaks in which a pathogen was identified (Table 8). Fish or shellfish were the vehicles of transmission in 75% of the outbreaks of diseases caused by chemicals. Food eaten in a restaurant was associated with 41% of outbreaks, and food eaten at home, with 28% (Table 13). The proportion of foodborne illness due to known etiologic agents was highest in August (Table 18).

1986

In 1986, 467 outbreaks (12,781 cases) of foodborne disease were reported to CDC. Reports were received from 38 states, as well as from the District of Columbia, Guam, and Puerto Rico (Figure 4). New York reported the largest number of outbreaks (129),

with 30 from New York City; Washington reported the next largest number (55), followed by California (36), and Hawaii (28). The etiologic agent was confirmed in 181 (39%) of the 467 outbreaks (Table 4).

Bacterial pathogens accounted for 119 outbreaks (4,855 cases). *Salmonella* caused most of the bacterial foodborne disease outbreaks (61 outbreaks, 2,833 cases), followed by *C. botulinum* (22 outbreaks, 27 cases) and *Shigella* (13 outbreaks, 773 cases). In Texas, 347 persons contracted *Shigella sonnei* gastroenteritis. Shredded lettuce was implicated. Examination of the plant suggested that a food handler may have contaminated the lettuce. Laboratory experiments showed that *Shigella* multiplies on shredded lettuce at room temperature. A multistate outbreak of *Salmonella enteritidis* infections caused by commercially frozen pasta affected >100 persons. Thirteen were hospitalized, and one person died. The implicated pasta was labeled as fully cooked, although it contained raw eggs.

Chemical agents caused 48 outbreaks (215 cases). Parasites caused eight outbreaks (68 cases), of which two were associated with *G. lambiia*. In one outbreak, fruit salad eaten at a family gathering in New Jersey was the vehicle. The woman who made the salad had an asymptomatic child in diapers; *Giardia* was identified in stool samples from the mother, the child, and their pet rabbit. Another outbreak of *Giardia* infection was associated with consumption of sandwiches at a nursing home. Viral agents caused six outbreaks. Most of the 666 cases were due to Norwalk virus.

Eleven deaths from foodborne illness were reported, all of which were associated with bacterial pathogens: seven from *Salmonella*, three from *C. botulinum*, one from *Shigella*. Incubation periods were known for illnesses in 330 outbreaks. In 19 outbreaks, the incubation period was <1 hour; in 87, it was 1-7 hours; in 73, it was 8-14 hours; and in 151 outbreaks, it was ≥15 hours.

The food vehicle of transmission was determined in 75% of the 181 outbreaks in which a pathogen was identified (Table 9). Fish or shellfish were the vehicles of transmission in 83% of the outbreaks of diseases caused by chemicals. Food eaten in a restaurant was associated with 45% of outbreaks, and food eaten at home, with 23% (Table 14). The proportion of foodborne illness due to known etiologic agents was highest in July (Table 19).

1987

In 1987, 387 outbreaks (16,500 cases) of foodborne disease were reported to CDC. Reports were received from 34 states as well as from the District of Columbia and Puerto Rico (Figure 5). New York reported the largest number of outbreaks (136), with 24 from New York City; Washington reported the next largest number (47), followed by California (31) and Wisconsin (21). The etiologic agent was confirmed in 136 (35%) of the 387 outbreaks (Table 5).

Bacterial pathogens accounted for 83 outbreaks (8,928 pathogens). *Salmonella* caused most of the bacterial foodborne disease outbreaks (52 outbreaks, 1,846 cases), followed by *C. botulinum* (11 outbreaks, 18 cases) and *Shigella* (9 outbreaks, 6,494 cases). Of the many outbreaks caused by *S. enteritidis*, one involved 40 people who ate eggs at a restaurant in Delaware. An outbreak of *S. sonnei* infection occurred at a

mass gathering in a North Carolina forest. Thousands of attendees became ill; illness was associated with communal meals and poor hygienic conditions.

Chemical agents caused 39 outbreaks (157 cases), including 95 cases caused by scombrotoxin. All four parasitic disease outbreaks (15 cases) were caused by *T. spiralis*. Of the 10 viral outbreaks, nine were caused by hepatitis A, but most of the 552 cases were from the one Norwalk virus outbreak.

Five deaths from foodborne illness were reported: two from *C. botulinum*, two from *Salmonella*, and one from mushroom poisoning. Incubation periods were known for 284 outbreaks. In 15 outbreaks, the incubation period was <1 hour; in 56, it was 1-7 hours; in 64, it was 8-14 hours; and in 149, it was ≥15 hours.

The food vehicle of transmission was determined in 58% of the 136 outbreaks in which a pathogen was identified (Table 10). Fish was the vehicle of transmission in 85% of the outbreaks of diseases caused by chemicals. Food eaten in a restaurant was associated with 58% of outbreaks, and food eaten at home, with 12% (Table 15). The proportion of foodborne illness due to known etiologic agents was highest in July (Table 20).

DISCUSSION

Among outbreaks in which the etiology was determined, bacterial pathogens caused the largest number of outbreaks (66%) and cases (92%) during the years 1983-1987. Chemical agents caused 26% of the outbreaks and 2% of the cases; parasites, 4% of the outbreaks and <1% of the cases; and viruses, 5% of the outbreaks and 5% of the cases. These proportions are similar to those of previous years. The discrepancies between the number of outbreaks and the number of cases attributed to each etiologic agent emphasizes the importance of evaluating both numbers before drawing conclusions about the contribution of particular pathogens or vehicles to foodborne disease.

Salmonella accounted for 57% of the bacterial disease outbreaks for the 5-year period and was the most frequently reported bacterial pathogen for each year. Fish poisoning due to ciguatoxin and scombrotoxin accounted for 73% of the outbreaks due to chemical agents. *T. spiralis* caused all parasitic disease outbreaks for 3 of the 5 years; three *Giardia* outbreaks occurred during the other 2 years. Hepatitis A caused 71% of the outbreaks due to viruses. The low number of reported oubreaks due to Norwalk agent and other viruses reflects the limitations of current laboratory techniques for detecting these infections.

The number of reported outbreaks decreased by 23% between 1983 and 1987. This decrease does not necessarily represent a true decrease in the number of foodborne disease outbreaks, because the number of sporadic cases of *Salmonella* infection (reported to a different surveillance system) has increased over this period. Many of these sporadic cases suggest unreported outbreaks. The decrease in reported outbreaks parallels the increased workload placed on health departments by the acquired immunodeficiency syndrome (AIDS) epidemic and is most likely due to limited resources for outbreak investigations. Although the number of reported outbreaks decreased, the number of cases involved in outbreaks did not.

The number of outbreaks in which the etiologic agent was not confirmed was about 60% for each of the 5 years from 1983 to 1987. This large percentage reflects the need for improved investigative skills so that known pathogens can be identified more frequently, and new and unidentified pathogens can be recognized.

Inconsistencies in reporting can be seen by examining the distribution of outbreaks by state. A few states, such as New York, California, Washington, and Hawaii, account for a disproportionate number of the outbreaks. Although these states could have a higher rate of foodborne disease, these figures more likely represent differences in degree of surveillance activity. Variability in reporting can also be seen when the frequencies of different pathogens are studied. Outbreaks due to *C. botulinum* were reported more commonly than those due to *Campylobacter*, a finding that indicates only that botulism is reported more comprehensively than some other illnesses.

For each year from 1983 to 1987, the most commonly reported food-preparation practice that contributed to foodborne disease was improper storage or holding temperature, followed by poor personal hygiene of the food handler (Tables 21-25). Food obtained from an unsafe source was the least commonly reported factor for all 5 years. Inadequate cooking and contaminated equipment each ranked third or fourth in each of the 5 years. In most outbreaks caused by bacterial pathogens, the food was stored at improper holding temperatures. In outbreaks of trichinosis, the food was usually inadequately cooked. In outbreaks of ciguatera and mushroom poisoning, the food itself was unsafe, and illness was not related to improper handling or preparation.

The objective of this report is to present simple analyses of the data on outbreaks of foodborne disease reported for the years 1983-1987. Because of the size and complexity of the data base and the limitations noted under **Interpretation of Data**, no attempt has been made to draw sweeping conclusions. Rather, these data will be analyzed in detail, along with other relevant data, to answer questions of public health importance, and findings will be published in the scientific literature.

TABLE 1. Confirmed foodborne disease outbreaks, cases, and deaths, by etiologic agent—United States, 1983

Etiologic agent	Outbreaks		Cases		Deaths	
	No.	%	No.	%	No.	%
BACTERIAL						
Brucella	1	0.5	29	0.4	1	2.9
Campylobacter	8	4.3	162	2.0	1	2.9
Clostridium botulinum	13	7.0	46	0.6	3	8.6
Clostridium perfringens	5	2.7	353	4.5	0	0.0
Escherichia coli	3	1.6	157	2.0	0	0.0
Salmonella	72	38.5	2,427	30.7	7	20.0
Shigella	7	3.7	1,993	25.2	0	0.0
Staphylococcus aureus	14	7.5	1,257	15.9	0	0.0
Streptococcus, Group A	1	0.5	535	6.8		
Streptococcus, other	1	0.5	16	0.2	3	8.6
Other bacterial	2	1.1	107	1.4	18	51.4
Total	127	67.9	7,082	89.6	33	94.3
CHEMICAL						
Ciguatoxin	13	7.0	43	0.5	0	0.0
Heavy metals	4	2.1	97	1.2	0	0.0
Mushrooms	5	2.7	23	0.3	1	2.9
Scombrotoxin	13	7.0	27	0.3	0	0.0
Other chemical	10	5.3	74	0.9	0	0.0
Total	45	24.1	264	3.3	1	2.9
PARASITIC						
Trichinella spiralis	4	2.1	8	0.1	0	0.0
Total	4	2.1	8	0.1	0	0.0
VIRAL						
Hepatitis A	10	5.3	530	6.7	1	2.9
Norwalk virus	1	0.5	20	0.3	0	0.0
Total	11	5.9	550	7.0	1	2.9
CONFIRMED TOTAL	187	100.0	7,904	100.0	35	100.0

TABLE 2. Confirmed foodborne disease outbreaks, cases, and deaths, by etiologic agent—United States, 1984

Etiologic agent	Outbreaks		Cases		Deaths	
	No.	%	No.	%	No.	%
BACTERIAL						
Bacillus cereus	3	1.6	23	0.3	0	0.0
Campylobacter	4	2.2	125	1.5	0	0.0
Clostridium botulinum	11	5.9	16	0.2	0	0.0
Clostridium perfringens	8	4.3	882	10 8	2	18.2
Escherichia coli	2	1.1	76	0.9	4	36.4
Salmonella	78	42.2	4,479	54.7	3	27.3
Shigella	9	4.9	470	5.7	1	9.1
Staphylococcus aureus	11	5.9	1,153	14.1	0	0.0
Streptococcus, Group A	2	1.1	83	1.0	0	0.0
Total	128	69.2	7,307	89.2	10	90.9
CHEMICAL						
Ciguatoxin	18	9.7	78	1.0	0	0.0
Heavy metals	3	1.6	44	0.5	0	0.0
Monosodium glutamate	2	1.1	7	0.1	0	0.0
Mushrooms	2	1.1	4	0.0	0	0.0
Scombrotoxin	13	7.0	67	0.8	0	0.0
Other chemical	4	2.2	16	0.2	1	9.1
Total	42	22.7	216	2.6	1	9.1
PARASITIC						
Trichinella spiralis	11	5.9	60	0.7	0	0.0
Total	11	5.9	60	0.7	0	0.0
VIRAL						
Hepatitis A	2	1.1	29	0.4	0	0.0
Norwalk virus	1	0.5	137	1.7	0	0.0
Other viral	1	0.5	444	5.4	0	0.0
Total	4	2.2	610	7.4	0	0.0
CONFIRMED TOTAL	185	100.0	8,193	100.0	11	100.0

TABLE 3. Confirmed foodborne disease outbreaks, cases, and deaths, by etiologic agent—United States, 1985

Etiologic agent	Outbreaks		Cases		Deaths	
	No.	%	No.	%	No.	%
BACTERIAL						
Bacillus cereus	7	3.2	42	0.2	0	0.0
Brucella	1	0.5	9	0.0	0	0.0
Campylobacter	9	4.1	174	0.8	0	0.0
Clostridium botulinum	17	7.7	33	0.1	2	2.7
Clostridium perfringens	6	2.7	1,016	4.4	0	0.0
Escherichia coli	1	0.5	370	1.6	0	0.0
Salmonella	79	35.9	19,660	85.5	20	26.7
Shigella	6	2.7	241	1.0	0	0.0
Staphylococcus aureus	14	6.4	421	1.8	0	0.0
Streptococcus, group A	1	0.5	12	0.1	0	0.0
Vibrio cholerae	1	0.5	2	0.0	0	0.0
Other bacterial	1	0.5	152	0.7	52	69.3
Total	143	65.0	22,132	96.3	74	98.7
CHEMICAL						
Ciguatoxin	27	12.3	106	0.5	0	0.0
Heavy metals	3	1.4	13	0.1	0	0.0
Mushrooms	1	0.5	4	0.0	0	0.0
Scombrotoxin	15	6.8	57	0.2	0	0.0
Shellfish	2	0.9	3	0.0	0	0.0
Other chemical	10	4.5	209	0.9	0	0.0
Total	58	26.4	392	1.7	0	0.0
PARASITIC						
Giardia	1	0.5	13	0.1	0	0.0
Trichinella spiralis	8	3.6	39	0.2	1	1.3
Total	9	4.1	52	0.2	1	1.3
VIRAL						
Hepatitis A	5	2.3	118	0.5	0	0.0
Norwalk virus	4	1.8	179	0.8	0	0.0
Other viral	1	0.5	114	0.5	0	0.0
Total	10	4.5	411	1.8	0	0.0
CONFIRMED TOTAL	220	100.0	22,987	100.0	75	100.0

TABLE 4. Confirmed foodborne disease outbreaks, cases, and deaths, by etiologic agent—United States, 1986

Etiologic agent	Outbreaks		Cases		Deaths	
	No.	%	No.	%	No.	%
BACTERIAL						
Bacillus cereus	4	2.2	187	3.2	0	0.0
Campylobacter	4	2.2	227	3.9	0	0.0
Clostridium botulinum	22	12.2	27	.5	3	27.3
Clostridium perfringens	3	1.7	202	3.5	0	0.0
Escherichia coli	1	0.6	37	0.6	0	0.0
Salmonella	61	33.7	2,833	48.8	7	63.6
Shigella	13	7.2	773	13.3	1	9.1
Staphylococcus aureus	7	3.9	250	4.3	0	0.0
Streptococcus, group A	2	1.1	248	4.3	0	0.0
Streptococcus, other	1	0.6	69	1.2	0	0.0
Vibrio parahemolyticus	1	0.6	2	0.0	0	0.0
Total	119	65.7	4,855	83.6	11	100.0
CHEMICAL						
Ciguatoxin	18	9.9	70	1.2	0	0.0
Heavy metals	1	0.6	3	0.1	0	0.0
Mushrooms	4	2.2	16	0.3	0	0.0
Scombrotoxin	20	11.0	60	1.0	0	0.0
Other chemical	5	2.8	66	1.1	0	0.0
Total	48	26.5	215	3.7	0	0.0
PARASITIC						
Giardia	2	1.1	28	0.5	0	0.0
Trichinella spiralis	6	3.3	40	0.7	0	0.0
Total	8	4.4	68	1.2	0	0.0
VIRAL						
Hepatitis A	3	1.7	203	3.5	0	0.0
Norwalk virus	3	1.7	463	8.0	0	0.0
Total	6	3.3	666	11.5	0	0.0
CONFIRMED TOTAL	181	100.0	5,804	100.0	11	100.0

TABLE 5. Confirmed foodborne disease outbreaks, cases, and deaths, by etiologic agent—United States, 1987

Etiologic agent	Outbreaks		Cases		Deaths	
	No.	%	No.	%	No.	%
BACTERIAL						
Bacillus cereus	2	1.5	9	0.1	0	0.0
Campylobacter	3	2.2	39	0.4	0	0.0
Clostridium botulinum	11	8.1	18	0.2	2	40.0
Clostridium perfringens	2	1.5	290	3.0	0	0.0
Salmonella	52	38.2	1,846	19.1	2	40.0
Shigella	9	6.6	6,494	67.3	0	0.0
Staphylococcus aureus	1	0.7	100	1.0	0	0.0
Streptococcus, group A	1	0.7	123	1.3	0	0.0
Vibrio parahemolyticus	2	1.5	9	0.1	0	0.0
Other Bacterial						
Total	83	61.0	8,928	92.5	4	80.0
CHEMICAL						
Ciguatoxin	11	8.1	35	0.4	0	0.0
Heavy metals	2	1.5	19	0.2	0	0.0
Mushrooms	2	1.5	2	0.0	1	20.0
Scombrotoxin	22	16.2	95	1.0	0	0.0
Other chemical	2	1.5	6	0.1	0	0.0
Total	39	28.7	157	1.6	1	20.0
PARASITIC						
Trichinella spiralis	4	2.9	15	0.2	0	0.0
Total	4	2.9	15	0.2	0	0.0
VIRAL						
Hepatitis A	9	6.6	187	1.9	0	0.0
Norwalk virus	1	0.7	365	3.8	0	0.0
Total	10	7.4	552	5.7	0	0.0
CONFIRMED TOTAL	136	100.0	9,652	100.0	5	100.0

TABLE 6. Foodborne outbreaks, by etiologic agent

Etiologic agent	Beef	Ham	Pork	Sausage	Chicken	Turkey	Other meats & stews	Shellfish	Other fish	Milk	Cheese	Eggs	Ice cream
BACTERIAL													
Brucella	–	–	–	–	–	–	–	–	–	–	1	–	–
Campylobacter	–	–	–	–	–	–	–	–	–	8	–	–	–
C. botulinum	–	–	–	–	–	–	1	–	1	–	–	–	–
C. perfringens	1	–	–	–	–	–	–	–	–	–	–	–	–
E. coli	–	–	–	–	–	–	–	–	–	–	3	–	–
Salmonella	3	1	–	–	3	1	2	1	–	1	–	1	–
Shigella	–	–	–	–	–	–	1	1	–	–	–	–	–
S. aureus	–	2	1	–	–	–	–	1	–	–	–	1	–
Streptococcus, group A	–	–	–	–	–	–	–	–	–	–	–	–	–
Streptococcus, other	–	–	–	–	–	–	–	–	–	–	1	–	–
Other	–	–	–	–	–	–	–	–	–	1	–	–	–
Total	4	3	1	–	3	1	4	3	1	10	5	2	–
CHEMICAL													
Ciguatoxin	–	–	–	–	–	–	–	–	13	–	–	–	–
Heavy metals	–	–	–	–	–	–	–	–	–	–	–	–	–
Mushrooms	–	–	–	–	–	–	–	–	–	–	–	–	–
Scombrotoxin	–	–	–	–	–	–	–	–	13	–	–	–	–
Other chemical	–	–	–	–	–	–	–	–	–	–	–	–	1
Total	–	–	–	–	–	–	–	–	26	–	–	–	1
PARASITIC													
Trichinella spiralis	1	–	3	–	–	–	–	–	–	–	–	–	–
Total	1	–	3	–	–	–	–	–	–	–	–	–	–
VIRAL													
Hepatitis A	–	–	–	–	–	–	–	–	–	–	–	–	–
Norwalk virus	–	–	–	–	–	–	–	1	–	–	–	–	–
Total	–	–	–	–	–	–	–	1	–	–	–	–	–
CONFIRMED TOTAL	5	3	4	–	3	1	4	4	27	10	5	2	1
UNKNOWN	4	–	1	2	3	2	3	19	3	1	1	–	–
TOTAL	9	3	5	2	6	3	7	23	30	11	6	2	1

and vehicle of transmission—United States, 1983

Baked foods	Fruits & vegetables	Potato salad	Poultry, fish,or egg salad	Other salad	Chinese food	Mexican food	Carbonated drink	Non-dairy beverage	Multiple foods	Mushrooms	Unknown	Total
–	–	–	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	8
–	6	–	–	–	–	1	–	1	–	2	1	13
–	–	–	–	–	–	3	–	–	–	–	1	5
–	–	–	–	–	–	–	–	–	–	–	–	3
1	2	2	–	2	–	–	–	–	19	–	33	72
–	1	–	–	1	–	–	–	–	–	–	3	7
1	–	2	–	–	–	–	–	–	6	–	–	14
–	–	1	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	1	2
2	9	5	–	3	–	4	–	1	25	2	39	127
–	–	–	–	–	–	–	–	–	–	–	–	13
–	1	–	–	–	–	–	2	1	–	–	–	4
–	–	–	–	–	–	–	–	–	–	5	–	5
–	–	–	–	–	–	–	–	–	–	–	–	13
2	–	–	–	–	–	–	1	1	5	–	–	10
2	1	–	–	–	–	–	3	2	5	5	–	45
–	–	–	–	–	–	–	–	–	–	–	–	4
–	–	–	–	–	–	–	–	–	–	–	–	4
–	1	–	–	–	–	–	–	–	–	–	9	10
–	–	–	–	–	–	–	–	–	–	–	–	1
–	1	–	–	–	–	–	–	–	–	–	9	11
4	11	5	–	3	–	4	3	3	30	7	48	187
2	2	2	3	5	1	6	–	2	34	–	222	318
6	13	7	3	8	1	10	3	5	64	7	270	505

TABLE 7. Foodborne outbreaks, by etiologic agent

Etiologic agent	Beef	Ham	Pork	Sausage	Chicken	Turkey	Other meats & stews	Shellfish	Other fish	Milk	Ice cream	Other dairy	Baked foods
BACTERIAL													
B. cereus	1	–	–	–	–	–	–	–	–	–	–	–	–
Campylobacter	–	–	–	–	–	–	–	–	–	1	–	–	–
C. botulinum	–	–	–	–	–	1	3	–	1	–	–	–	–
C. perfringens	–	–	–	–	1	1	–	–	–	–	–	–	–
E. coli	1	–	–	–	–	–	–	–	–	–	–	–	–
Salmonella	4	1	1	–	3	1	2	–	–	1	1	–	–
Shigella	–	–	–	–	–	–	–	–	–	–	–	–	–
S. aureus	1	–	2	–	–	1	–	–	–	–	–	–	2
Streptococcus, group A	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	7	1	3	–	4	4	5	–	1	2	1	–	2
CHEMICAL													
Ciguatoxin	–	–	–	–	–	–	–	–	18	–	–	–	–
Heavy metals	–	–	–	–	–	–	–	–	–	–	–	–	–
Monosodium glutamate	–	–	–	–	–	–	–	–	–	–	–	–	–
Mushrooms	–	–	–	–	–	–	–	–	–	–	–	–	–
Scombrotoxin	–	–	–	–	–	–	–	–	12	–	–	–	–
Other chemical	–	–	–	–	–	–	–	–	–	–	–	–	1
Total	–	–	–	–	–	–	–	–	30	–	–	–	1
PARASITIC													
Trichinella spiralis	–	–	7	1	–	–	3	–	–	–	–	–	–
Total	–	–	7	1	–	–	3	–	–	–	–	–	–
VIRAL													
Hepatitis A	–	–	–	–	–	–	–	–	–	–	–	–	–
Norwalk virus	–	–	–	–	–	–	–	–	–	–	–	–	–
Other viral	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	–	–	–	–	–	–	–	–	–	–	–
CONFIRMED TOTAL	7	1	10	1	4	4	8	–	31	2	1	–	3
UNKNOWN	9	2	1	–	3	5	2	9	1	3	–	1	1
TOTAL 1984	16	3	11	1	7	9	10	9	32	5	1	1	4

and vehicle of transmission—United States, 1984

Fruits & vegetables	Potato salad	Poultry, fish, or egg salad	Other salad	Chinese food	Fried rice	Mexican food	Carbonated drink	Non-dairy beverage	Multiple foods	Mushrooms	Unknown	Total
–	–	–	–	1	–	–	–	–	1	–	–	3
–	–	–	–	–	–	–	–	–	1	–	2	4
6	–	–	–	–	–	–	–	–	–	–	–	11
–	–	–	1	–	–	2	–	–	2	–	1	8
–	–	–	–	–	–	–	–	–	1	–	–	2
–	1	2	2	–	–	2	1	–	14	–	42	78
–	–	–	1	–	–	–	–	–	3	–	5	9
–	–	1	–	–	–	–	–	–	3	–	1	11
–	–	1	–	–	–	–	–	–	1	–	–	2
6	1	4	4	1	–	4	1	–	26	–	51	128
–	–	–	–	–	–	–	–	–	–	–	–	18
–	–	–	–	–	–	–	–	2	1	–	–	3
–	–	–	–	2	–	–	–	–	–	–	–	2
–	–	–	–	–	–	–	–	–	–	2	–	2
–	–	–	–	–	–	–	–	–	–	–	1	13
–	–	–	–	2	–	–	–	–	2	–	1	4
–	–	–	–	2	–	–	–	2	3	2	2	42
–	–	–	–	–	–	–	–	–	–	–	–	11
–	–	–	–	–	–	–	–	–	–	–	–	11
–	–	–	–	–	–	–	–	–	–	–	2	2
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	2	–	2	4
6	1	4	4	3	–	4	1	2	31	2	55	185
2	1	–	3	4	1	3	2	–	51	–	254	358
8	2	4	7	7	1	7	3	2	82	2	309	543

TABLE 8. Foodborne outbreaks, by etiologic agent

Etiologic agent	Beef	Ham	Pork	Sausage	Chicken	Turkey	Other meats & stews	Shellfish	Other fish	Milk	Cheese	Eggs	Baked foods
BACTERIAL													
B. cereus	–	–	–	–	–	–	–	1	–	–	–	–	–
Brucella	–	–	–	–	–	–	–	–	–	–	1	–	–
Campylobacter	–	–	–	–	1	–	–	–	–	2	–	–	–
C. botulinum	–	–	–	–	–	–	4	–	4	–	–	–	–
C. perfringens	1	–	–	–	–	1	–	–	–	–	–	–	–
E. coli	–	–	–	–	–	–	–	–	–	–	–	–	–
Salmonella	5	–	–	1	4	2	1	–	1	2	1	3	1
Shigella	–	–	–	–	–	–	–	–	–	–	–	–	–
S. aureus	1	3	–	–	–	1	1	–	–	–	–	–	1
Streptococcus, group A	–	–	–	–	–	–	–	–	–	–	–	–	–
V. cholerae	–	–	–	–	–	–	–	–	1	–	–	–	–
Other bacterial	–	–	–	–	–	–	–	–	–	–	1	–	–
Total	7	3	–	1	5	4	6	1	6	4	3	3	2
CHEMICAL													
Ciguatoxin	–	–	–	–	–	–	–	–	26	–	–	–	–
Heavy metals	–	–	–	–	–	–	–	–	–	–	–	–	–
Mushrooms	–	–	–	–	–	–	–	–	–	–	–	–	–
Scombrotoxin	–	–	–	–	–	–	–	–	14	–	–	–	–
Shellfish	–	–	–	–	–	–	–	2	–	–	–	–	–
Other chemical	1	–	–	–	–	–	–	–	–	2	–	–	–
Total	1	–	–	–	–	–	–	2	40	2	–	–	–
PARASITIC													
Giardia	–	–	–	–	–	–	–	–	–	–	–	–	–
Trichinella spiralis	–	–	5	–	–	–	2	–	–	–	–	–	–
Total	–	–	5	–	–	–	2	–	–	–	–	–	–
VIRAL													
Hepatitis A	–	–	–	–	–	–	–	–	–	–	–	–	–
Norwalk virus	–	–	–	–	–	–	–	–	–	–	–	–	–
Other viral	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	–	–	–	–	–	–	–	–	–	–	–	–
CONFIRMED TOTAL	8	3	5	1	5	4	8	3	46	6	3	3	2
UNKNOWN	3	1	–	–	–	2	–	3	3	–	1	–	1
TOTAL 1985	11	4	5	1	5	6	8	6	49	6	4	3	3

agent and vehicle of transmission, United States, 1985

Fruits & vegetables	Potato salad	Poultry, fish, or egg salad	Other salad	Chinese food	Fried rice	Mexican food	Carbonated drink	Nondairy beverage	Multiple foods	Mushrooms	Unknown	Total
1	–	–	–	1	2	–	–	–	–	–	2	7
	–	–	–	–	–	–	–	–	–	–	–	1
1	–	–	–	–	–	–	–	–	2	–	3	9
7	–	–	–	–	–	1	–	–	–	–	1	17
–	–	–	–	–	–	1	–	–	3	–	–	6
–	–	–	–	–	–	1	–	–	–	–	–	1
2	–	1	–	–	–	–	–	1	19	–	35	79
1	–	–	–	–	–	–	–	–	3	–	2	6
1	1	2	–	–	–	–	–	–	2	–	1	14
–	–	–	–	–	–	–	–	–	–	–	1	1
–	–	–	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	1
13	1	3	–	1	2	3	–	1	29	–	45	143
–	–	–	–	–	–	–	–	–	–	–	1	27
–	–	–	–	–	–	–	2	–	1	–	–	3
–	–	–	–	–	–	–	–	–	–	1	–	1
–	–	–	–	–	–	–	–	–	–	–	1	15
–	–	–	–	–	–	–	–	–	–	–	–	2
3	–	–	1	–	–	–	–	1	2	–	–	10
3	–	–	1	–	–	–	2	1	3	1	2	58
–	–	–	–	–	–	–	–	–	–	–	1	1
–	–	–	–	–	–	–	–	–	–	–	1	8
–	–	–	–	–	–	–	–	–	–	–	2	9
–	–	–	1	–	–	–	–	–	–	–	4	5
–	–	–	1	–	–	–	–	–	1	–	2	4
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	2	–	–	–	–	–	2	–	6	10
16	1	3	3	1	2	3	2	2	34	1	55	220
2	1	2	2	–	–	7	–	–	28	–	219	275
18	2	5	5	1	2	10	2	2	62	1	274	495

TABLE 9. Foodborne outbreaks, by etiologic agent

Etiologic agent	Beef	Ham	Pork	Chicken	Turkey	Other meats & stews	Shellfish	Other fish	Milk	Eggs	Ice cream	Other dairy	Baked foods
BACTERIAL													
B. cereus	–	–	–	–	–	–	–	–	–	–	–	–	–
Campylobacter	–	–	–	–	–	–	–	–	1	–	–	–	–
C. botulinum	–	–	1	–	–	2	–	2	–	–	–	–	–
C. perfringens	–	–	–	–	1	–	–	–	–	–	–	–	–
E. coli	–	–	–	–	–	–	–	–	–	–	–	–	–
Salmonella	5	–	1	2	2	1	–	1	–	1	–	–	2
Shigella	–	–	–	2	–	–	1	–	–	–	–	–	–
S. aureus	–	1	–	–	1	–	–	–	–	–	–	–	–
Streptococcus, group A	–	–	–	–	–	–	–	–	–	–	–	–	–
Streptococcus, other	–	–	–	–	–	–	–	–	–	–	–	–	–
V. parahemolyticus	–	–	–	–	–	–	1	–	–	–	–	–	–
Total	5	1	2	4	4	3	2	3	1	1	–	–	2
CHEMICAL													
Ciguatoxin	–	–	–	–	–	–	–	18	–	–	–	–	–
Heavy metals	–	–	–	–	–	–	–	–	–	–	–	–	–
Mushrooms	–	–	–	–	–	–	–	–	–	–	–	–	–
Scombrotoxin	–	–	–	–	–	–	–	20	–	–	–	–	–
Other chemical	–	–	–	–	–	–	1	1	–	–	1	1	–
Total	–	–	–	–	–	–	1	39	–	–	1	1	–
PARASITIC													
Giardia	–	–	–	–	–	–	–	–	–	–	–	–	–
Trichinella spiralis	–	–	4	–	–	2	–	–	–	–	–	–	–
Total	–	–	4	–	–	2	–	–	–	–	–	–	–
VIRAL													
Hepatitis A	–	–	–	–	–	–	–	–	–	–	–	–	–
Norwalk virus	–	–	–	–	–	–	–	–	–	1	–	–	–
Total	–	–	–	–	–	–	–	–	–	1	–	–	–
CONFIRMED TOTAL	5	1	6	4	4	5	3	42	1	2	1	1	2
UNKNOWN	4	4	–	1	1	1	2	1	–	–	1	1	5
TOTAL	9	5	6	5	5	6	5	43	1	2	2	2	7

and vehicle of transmission—United States, 1986

Fruits & vegetables	Potato salad	Poultry, fish, or egg salad	Other salad	Chinese food	Fried rice	Mexican food	Carbonated drink	Non-dairy beverage	Multiple foods	Mushrooms	Unknown	Total
–	–	–	–	–	1	–	–	–	3	–	–	4
–	–	1	–	1	–	–	–	–	–	–	1	4
10	–	–	–	–	–	–	–	–	1	–	6	22
–	–	–	–	–	–	–	–	–	1	–	1	3
–	–	–	–	–	–	–	–	–	1	–	–	1
1	1	–	–	–	–	1	–	–	12	–	31	61
1	1	1	2	–	–	1	–	–	1	–	3	13
–	–	1	–	–	–	–	–	–	4	–	–	7
–	–	–	–	–	–	–	–	–	–	–	2	2
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	1
12	2	3	2	1	1	2	–	–	24	–	44	119
–	–	–	–	–	–	–	–	–	–	–	–	18
–	–	–	–	–	–	–	1	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	4	–	4
–	–	–	–	–	–	–	–	–	–	–	–	20
–	–	–	–	–	–	–	–	–	1	–	–	5
–	–	–	–	–	–	–	1	–	1	4	–	48
1	–	–	–	–	–	–	–	–	1	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	6
1	–	–	–	–	–	–	–	–	1	–	–	8
–	–	–	1	–	–	–	–	–	–	–	2	3
1	–	–	–	–	–	–	–	–	1	–	–	3
1	–	–	1	–	–	–	–	–	1	–	2	6
14	2	3	3	1	1	2	1	–	27	4	46	181
2	1	–	4	–	–	1	–	2	35	–	220	286
16	3	3	7	1	1	3	1	2	62	4	266	467

TABLE 10. Foodborne outbreaks, by etiologic agent

Etiologic agent	Beef	Ham	Pork	Chicken	Turkey	Other meats & stews	Shellfish	Other fish	Milk	Cheese	Eggs	Ice cream	Other dairy
BACTERIAL													
B. cereus	–	–	–	–	–	–	–	–	–	–	–	–	–
Campylobacter	–	–	–	–	–	–	–	–	–	–	–	–	–
C. botulinum	–	–	–	–	–	–	–	2	–	–	–	–	–
C. perfringens	1	–	–	–	–	–	–	–	–	–	–	–	–
Salmonella	2	–	1	3	1	–	–	–	–	–	4	–	–
Shigella	–	–	–	–	–	–	–	–	–	–	–	–	–
S. aureus	–	–	–	–	–	–	–	–	–	–	–	–	–
Streptococcus, group A	–	–	–	–	–	–	–	–	–	–	–	–	–
V. parahemolyticus	–	–	–	–	–	–	1	–	–	–	–	–	–
Total	3	–	1	3	1	–	1	2	–	–	4	–	–
CHEMICAL													
Ciguatoxin	–	–	–	–	–	–	–	11	–	–	–	–	–
Heavy metals	–	–	–	–	–	–	–	–	–	–	–	–	–
Mushrooms	–	–	–	–	–	–	–	–	–	–	–	–	–
Scombrotoxin	–	–	–	–	–	–	–	22	–	–	–	–	–
Other chemical	–	–	–	–	–	–	–	–	1	–	–	–	–
Total	–	–	–	–	–	–	–	33	1	–	–	–	–
PARASITIC													
Trichinella spiralis	–	–	3	–	–	1	–	–	–	–	–	–	–
Total	–	–	3	–	–	1	–	–	–	–	–	–	–
VIRAL													
Hepatitis A	–	1	–	–	–	–	–	–	–	–	–	–	–
Norwalk virus	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	–	1	–	–	–	–	–	–	–	–	–	–	–
CONFIRMED TOTAL	3	1	4	3	1	1	1	35	1	–	4	–	–
UNKNOWN	3	–	–	5	–	3	1	–	–	1	1	1	1
TOTAL	6	1	4	8	1	4	2	35	1	1	5	1	1

and vehicle of transmission—United States, 1987

Baked foods	Fruits & vegetables	Potato salad	Poultry, fish, or egg salad	Other salad	Chinese food	Mexican food	Carbonated drink	Non-dairy beverage	Multiple foods	Mushrooms	Unknown	Total
–	–	–	–	–	–	–	–	–	–	–	2	2
–	–	–	–	–	–	–	–	–	–	–	3	3
–	3	–	–	–	–	–	–	–	–	–	6	11
–	–	–	1	–	–	–	–	–	–	–	–	2
–	–	–	1	–	–	–	–	–	9	–	31	52
–	–	1	–	–	–	–	–	–	1	–	7	9
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	–	–	1	2
–	3	1	2	–	–	–	–	–	12	–	50	83
–	–	–	–	–	–	–	–	–	–	–	–	11
–	–	–	–	–	–	–	1	1	–	–	–	2
–	–	–	–	–	–	–	–	–	–	2	–	2
–	–	–	–	–	–	–	–	–	–	–	–	22
1	–	–	–	–	–	–	–	–	–	–	–	2
1	–	–	–	–	–	–	1	1	–	2	–	39
–	–	–	–	–	–	–	–	–	–	–	–	4
–	–	–	–	–	–	–	–	–	–	–	–	4
–	–	–	–	–	–	–	–	–	1	–	7	9
–	–	–	–	–	–	–	–	–	1	–	–	1
–	–	–	–	–	–	–	–	–	2	–	7	10
1	3	1	2	–	–	–	1	1	14	2	57	136
2	1	2	2	6	1	4	–	1	37	–	179	251
3	4	3	4	6	1	4	1	2	51	2	236	387

TABLE 11. Foodborne disease outbreaks, by etiologic agent and place where food was eaten—United States, 1983

Etiologic Agent	Home	Delicatessen, cafeteria, or restaurant	School	Picnic	Church	Camp	Other	Unknown	Total
BACTERIAL									
Brucella	1	–	–	–	–	–	–	–	1
Campylobacter	6	–	–	–	–	–	2	–	8
C. botulinum	11	1	–	–	–	–	–	1	13
C. perfringens	–	2	2	–	1	–	–	–	5
E. coli	1	–	–	–	–	–	2	–	3
Salmonella	16	24	5	2	3	1	20	1	72
Shigella	1	4	–	1	–	–	–	1	7
S. aureus	2	1	2	1	1	1	6	–	14
Streptococcus, group A	–	–	–	–	1	–	–	–	1
Streptococcus, other	1	–	–	–	–	–	–	–	1
Other bacterial	1	–	–	–	–	–	1	–	2
Total	40	32	9	4	6	2	31	3	127
CHEMICAL									
Ciguatoxin	9	2	–	–	–	–	–	2	13
Heavy metals	–	1	1	–	1	–	1	–	4
Mushrooms	4	–	–	–	–	–	–	1	5
Scombrotoxin	3	8	–	–	–	–	2	–	13
Other chemical	5	–	1	–	–	–	3	1	10
Total	21	11	2	–	1	–	6	4	45
PARASITIC									
Trichinella spiralis	–	–	–	1	–	–	3	–	4
Total	–	–	–	1	–	–	3	–	4
VIRAL									
Hepatitis A	–	7	1	–	–	–	2	–	10
Norwalk virus	–	–	–	–	–	–	1	–	1
Total	–	7	1	–	–	–	3	–	11
CONFIRMED TOTAL	61	50	12	5	7	2	43	7	187
UNKNOWN	57	185	9	8	5	2	50	2	318
TOTAL 1983	118	235	21	13	12	4	93	9	505

TABLE 12. Foodborne disease outbreaks, by etiologic agent and place where food was eaten—United States, 1984

Etiologic Agent	Home	Delicatessen, cafeteria, or restaurant	School	Picnic	Church	Camp	Other	Unknown	Total
BACTERIAL									
B. cereus	1	2	–	–	–	–	–	–	3
Campylobacter	–	–	–	–	–	1	3	–	4
C. botulinum	10	1	–	–	–	–	–	–	11
C. perfringens	–	2	1	–	–	–	5	–	8
E. coli	–	–	–	–	–	–	2	–	2
Salmonella	8	41	3	3	1	–	20	2	78
Shigella	–	3	–	–	2	–	4	–	9
S. aureus	1	3	2	2	–	–	3	–	11
Streptococcus, group A	1	1	–	–	–	–	–	–	2
Total	21	53	6	5	3	1	37	2	128
CHEMICAL									
Ciguatoxin	13	–	–	–	–	–	1	4	18
Heavy metals	1	–	1	–	–	–	1	–	3
Monosodium glutamate	1	1	–	–	–	–	–	–	2
Mushrooms	2	–	–	–	–	–	–	–	2
Scombrotoxin	4	6	–	–	–	–	2	1	13
Other chemical	1	–	–	–	–	–	2	1	4
Total	22	7	1	–	–	–	6	6	42
PARASITIC									
Trichinella spiralis	2	–	–	–	–	–	9	–	11
Total	2	–	–	–	–	–	9	–	11
VIRAL									
Hepatitis A	–	–	1	–	–	–	1	–	2
Norwalk virus	–	–	–	–	–	–	1	–	1
Other viral	–	1	–	–	–	–	–	–	1
Total	–	1	1	–	–	–	2	–	4
CONFIRMED TOTAL	45	61	8	5	3	1	54	8	185
UNKNOWN	85	173	15	7	7	4	58	9	358
TOTAL 1984	130	234	23	12	10	5	112	17	543

TABLE 13. Foodborne disease outbreaks, by etiologic agent and place where food was eaten—United States, 1985

Etiologic Agent	Home	Delicatessen, cafeteria, or restaurant	School	Picnic	Church	Camp	Other	Unknown	Total
BACTERIAL									
B. cereus	1	3	1	–	1	–	–	1	7
Brucella	1	–	–	–	–	–	–	–	1
Campylobacter	2	2	–	2	–	–	3	–	9
C. botulinum	17	–	–	–	–	–	–	–	17
C. perfringens	1	4	–	–	–	–	1	–	6
E. coli	–	–	–	1	–	–	–	–	1
Salmonella	17	28	3	3	5	1	20	2	79
Shigella	–	4	–	–	–	–	2	–	6
S. aureus	2	–	1	–	3	–	7	1	14
Streptococcus, group A	–	1	–	–	–	–	–	–	1
V. cholera	1	–	–	–	–	–	–	–	1
Other bacterial	–	–	–	–	–	–	1	–	1
Total	42	42	5	6	9	1	34	4	143
CHEMICAL									
Ciguatoxin	20	2	–	1	–	–	–	4	27
Heavy metals	–	2	–	–	–	–	1	–	3
Mushrooms	1	–	–	–	–	–	–	–	1
Scombrotoxin	6	9	–	–	–	–	–	–	15
Shellfish	2	–	–	–	–	–	–	–	2
Other chemical	4	2	1	–	–	–	3	–	10
Total	33	15	1	1	–	–	4	4	58
PARASITIC									
Giardia	1	–	–	–	–	–	–	–	1
Trichinella spiralis	3	–	–	–	–	–	5	–	8
Total	4	–	–	–	–	–	5	–	9
VIRAL									
Hepatitis A	2	2	–	–	–	–	1	–	5
Norwalk virus	1	1	1	–	1	–	–	–	4
Other viral	–	1	–	–	–	–	–	–	1
Total	3	4	1	–	1	–	1	–	10
CONFIRMED TOTAL	82	61	7	7	10	1	44	8	220
UNKNOWN	51	135	18	4	13	6	40	8	275
TOTAL 1985	133	196	25	11	23	7	84	16	495

TABLE 14. Foodborne disease outbreaks, by etiologic agent and place where food was eaten—United States, 1986

Etiologic Agent	Home	Delicatessen, cafeteria, or restaurant	School	Picnic	Church	Camp	Other	Unknown	Total
BACTERIAL									
B. cereus	–	2	1	–	–	–	1	–	4
Campylobacter	–	1	1	–	–	–	2	–	4
C. botulinum	15	–	–	–	–	–	–	7	22
C. perfringens	–	1	–	–	–	–	2	–	3
E. coli	–	1	–	–	–	–	–	–	1
Salmonella	15	21	3	–	2	1	17	2	61
Shigella	1	8	1	–	–	–	3	–	13
S. aureus	1	1	1	–	–	–	4	–	7
Streptococcus, group A	–	1	1	–	–	–	–	–	2
Streptococcus, other	–	–	1	–	–	–	–	–	1
V. parahemolyticus	–	1	–	–	–	–	–	–	1
Total	32	37	9	–	2	1	29	9	119
CHEMICAL									
Ciguatoxin	16	–	–	–	–	–	–	2	18
Heavy metals	–	1	–	–	–	–	–	–	1
Mushrooms	2	–	–	–	–	–	2	–	4
Scombrotoxin	5	12	–	–	–	–	2	1	20
Other chemical	3	1	1	–	–	–	–	–	5
Total	26	14	1	–	–	–	4	3	48
PARASITIC									
Giardia	1	–	–	–	–	–	1	–	2
Trichinella spiralis	2	–	–	–	–	–	1	3	6
Total	3	–	–	–	–	–	2	3	8
VIRAL									
Hepatitis A	–	2	–	–	–	–	–	1	3
Norwalk virus	1	1	–	–	–	–	1	–	3
Total	1	3	–	–	–	–	1	1	6
CONFIRMED TOTAL	62	54	10	–	2	1	36	16	181
UNKNOWN	40	147	23	5	12	6	46	7	286
TOTAL 1986	102	201	33	5	14	7	82	23	467

TABLE 15. Foodborne disease outbreaks, by etiologic agent and place where food was eaten—United States, 1987

Etiologic Agent	Home	Delicatessen, cafeteria, or restaurant	School	Picnic	Church	Camp	Other	Unknown	Total
BACTERIAL									
B. cereus	2	–	–	–	–	–	–	–	2
Campylobacter	–	1	–	–	–	–	2	–	3
C. botulinum	3	–	–	–	–	–	–	8	11
C. perfringens	–	–	–	–	–	–	2	–	2
Salmonella	4	27	2	1	–	1	16	1	52
Shigella	2	2	–	–	–	2	3	–	9
S. aureus	–	–	–	1	–	–	–	–	1
Streptococcus, group A	1	–	–	–	–	–	–	–	1
V. parahemolyticus	2	–	–	–	–	–	–	–	2
Total	14	30	2	2	–	3	23	9	83
CHEMICAL									
Ciguatoxin	11	–	–	–	–	–	–	–	11
Heavy metals	1	–	1	–	–	–	–	–	2
Mushrooms	–	1	–	–	–	1	–	–	2
Scombrotoxin	4	17	–	1	–	–	–	–	22
Other chemical	1	1	–	–	–	–	–	–	2
Total	17	19	1	1	–	1	–	–	39
PARASITIC									
Trichinella spiralis	–	–	–	–	–	–	–	4	4
Total	–	–	–	–	–	–	–	4	4
VIRAL									
Hepatitis A	1	5	–	1	–	–	2	–	9
Norwalk virus	–	–	–	–	–	–	1	–	1
Total	1	5	–	1	–	–	3	–	10
CONFIRMED TOTAL	32	54	3	4	–	4	26	13	136
UNKNOWN	35	137	13	3	6	3	47	7	251
TOTAL 1987	67	191	16	7	6	7	73	20	387

TABLE 16. Foodborne disease outbreaks, by etiologic agent and month of occurrence—United States, 1983

Etiologic Agent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Un-known	Total
BACTERIAL														
Brucella	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Campylobacter	–	–	–	–	1	2	–	–	2	2	–	1	–	8
C. botulinum	1	1	2	–	1	1	1	1	–	2	3	–	–	13
C. perfringens	2	–	1	1	–	–	–	–	–	–	–	1	–	5
E. coli	–	–	–	–	–	–	–	–	1	1	1	–	–	3
Salmonella	4	3	3	5	9	6	7	5	11	8	5	6	–	72
Shigella	–	–	1	–	–	–	1	–	2	2	–	1	–	7
S. aureus	–	1	–	1	1	1	2	2	1	2	–	3	–	14
Streptococcus, group A	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Streptococcus, other	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Other bacterial	–	–	–	–	–	1	–	–	1	–	–	–	–	2
Total	7	6	7	7	12	11	12	8	19	17	9	12	–	127
CHEMICAL														
Ciguatoxin	1	–	1	–	–	1	–	2	2	1	4	1	–	13
Heavy metals	1	–	1	–	–	–	1	1	–	–	–	–	–	4
Mushrooms	–	–	1	–	–	–	–	1	–	1	1	1	–	5
Scombrotoxin	–	1	–	1	2	–	2	2	3	1	–	1	–	13
Other chemical	–	–	–	2	–	2	1	2	2	–	–	1	–	10
Total	2	1	3	3	2	3	4	8	7	3	5	4	–	45
PARASITIC														
Trichinella spiralis	–	–	1	–	–	2	–	–	1	–	–	–	–	4
Total	–	–	1	–	–	2	–	–	1	–	–	–	–	4
VIRAL														
Hepatitis A	2	–	3	–	–	1	–	1	2	–	–	–	1	10
Norwalk virus	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Total	2	–	3	–	1	1	–	1	2	–	–	–	1	11
CONFIRMED TOTAL	11	7	14	10	15	17	16	17	29	20	14	16	1	187
UNKNOWN	36	21	11	33	36	35	28	20	22	22	32	22	–	318
TOTAL 1983	47	28	25	43	51	52	44	37	51	42	46	38	1	505

TABLE 17. Foodborne disease outbreaks, by etiologic agent and month of occurrence—United States, 1984

Etiologic Agent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Un-known	Total
BACTERIAL														
B. cereus	–	1	–	–	–	1	–	–	1	–	–	–	–	3
Campylobacter	–	–	–	–	–	1	–	1	–	1	–	1	–	4
C. botulinum	–	–	1	–	1	–	1	3	2	1	2	–	–	11
C. perfringens	–	–	–	1	–	1	1	2	–	1	1	1	–	8
E. coli	–	–	–	1	–	–	–	–	1	–	–	–	–	2
Salmonella	2	1	6	9	5	11	6	12	12	9	3	2	–	78
Shigella	–	–	–	2	–	2	–	3	2	–	–	–	–	9
S. aureus	–	–	1	2	–	–	–	5	1	–	2	–	–	11
Streptococcus, group A	–	–	–	–	–	1	–	1	–	–	–	–	–	2
Total	2	2	8	15	6	17	8	27	19	12	8	4	–	128
CHEMICAL														
Ciguatoxin	1	–	3	2	3	2	1	3	2	1	–	–	–	18
Heavy metals	–	–	–	1	–	1	–	–	1	–	–	–	–	3
Monosodium glutamate	–	–	1	–	–	–	1	–	–	–	–	–	–	2
Mushrooms	–	–	–	1	–	–	–	–	1	–	–	–	–	2
Scombrotoxin	–	1	1	1	1	3	1	2	1	1	–	1	–	13
Other chemical	–	–	–	1	1	–	–	–	–	1	1	–	–	4
Total	1	1	5	6	5	6	3	5	5	3	1	1	–	42
PARASITIC														
Trichinella spiralis	1	1	1	1	2	2	–	–	1	–	–	2	–	11
Total	1	1	1	1	2	2	–	–	1	–	–	2	–	11
VIRAL														
Hepatitis A	–	–	–	–	–	1	–	–	–	1	–	–	–	2
Norwalk virus	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Other viral	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Total	–	1	–	–	1	1	–	–	–	1	–	–	–	4
CONFIRMED TOTAL	4	5	14	22	14	26	11	32	25	16	9	7	–	185
UNKNOWN	32	26	29	27	37	36	29	26	20	30	32	33	1	358
TOTAL 1984	36	31	43	49	51	62	40	58	45	46	41	40	1	543

TABLE 18. Foodborne disease outbreaks, by etiologic agent and month of occurrence—United States, 1985

Etiologic Agent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Un-known	Total
BACTERIAL														
B. cereus	–	–	–	1	–	–	–	2	2	2	–	–	–	7
Brucella	–	–	1	–	–	–	–	–	–	–	–	–	–	1
Campylobacter	–	–	–	2	1	–	–	2	–	2	–	2	–	9
C. botulinum	3	2	–	–	–	3	5	2	1	–	1	–	–	17
C. perfringens	–	1	–	1	–	1	–	2	–	–	–	1	–	6
E. coli	–	–	–	–	–	–	–	–	1	–	–	–	–	1
Salmonella	1	2	3	6	8	7	9	17	6	12	6	2	–	79
Shigella	–	–	–	1	–	1	1	1	–	1	1	–	–	6
S. aureus	1	1	–	–	1	1	2	2	3	2	–	1	–	14
Streptococcus, group A	–	–	–	–	–	–	–	1	–	–	–	–	–	1
V. cholerae	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Other bacterial	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Total	6	6	4	11	10	13	17	30	13	19	8	6	–	143
CHEMICAL														
Ciguatoxin	1	4	2	1	4	2	2	2	2	3	1	3	–	27
Heavy metals	–	–	–	1	–	1	–	–	–	–	1	–	–	3
Mushrooms	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Scombrotoxin	1	–	–	–	1	2	2	2	–	4	1	2	–	15
Shellfish	–	–	–	–	–	–	–	–	2	–	–	–	–	2
Other chemical	1	2	–	–	1	5	–	–	–	1	–	–	–	10
Total	3	6	2	2	6	10	5	4	4	8	3	5	–	58
PARASITIC														
Giardia	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Trichinella spiralis	3	–	1	–	–	1	–	–	1	2	–	–	–	8
Total	3	–	1	–	–	1	–	1	1	2	–	–	–	9
VIRAL														
Hepatitis A	1	–	–	–	–	–	1	1	–	1	–	1	–	5
Norwalk virus	–	–	–	–	–	–	2	–	–	1	1	–	–	4
Other viral	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Total	1	–	–	–	1	–	3	1	–	2	1	1	–	10
CONFIRMED TOTAL	13	12	7	13	17	24	25	36	18	31	12	12	–	220
UNKNOWN	12	19	17	42	30	23	27	23	14	20	22	25	1	275
TOTAL 1985	25	31	24	55	47	47	52	59	32	51	34	37	1	495

TABLE 19. Foodborne disease outbreaks, by etiologic agent and month of occurrence – United States, 1986

Etiologic Agent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
BACTERIAL													
B. cereus	1	–	1	–	2	–	–	–	–	–	–	–	4
Campylobacter	–	–	1	–	–	1	–	–	–	1	–	1	4
C. botulinum	3	2	2	–	–	1	3	2	2	5	–	2	22
C. perfringens	1	–	–	–	–	–	–	1	–	–	1	–	3
E. coli	–	–	–	–	–	–	–	–	–	1	–	–	1
Salmonella	3	–	4	7	7	6	8	4	8	6	7	1	61
Shigella	1	–	–	–	2	2	3	2	1	1	–	1	13
S. aureus	–	–	2	–	1	–	1	1	1	–	–	1	7
Streptococcus, group A	–	–	–	–	2	–	–	–	–	–	–	–	2
Streptococcus, other	–	–	–	–	–	–	–	–	–	–	–	1	1
V. parahemolyticus	–	–	–	–	–	–	–	–	1	–	–	–	1
Total	9	2	10	7	14	10	15	10	13	14	8	7	119
CHEMICAL													
Ciguatoxin	3	1	1	1	4	–	3	2	3	–	–	–	18
Heavy metals	–	–	–	–	–	–	1	–	–	–	–	–	1
Mushrooms	–	–	–	–	–	–	1	1	1	–	1	–	4
Scombrotoxin	1	1	3	–	1	2	2	1	4	1	2	2	20
Other chemical	–	–	–	2	1	1	–	–	–	–	–	1	5
Total	4	2	4	3	6	3	7	4	8	1	3	3	48
PARASITIC													
Giardia	–	–	1	–	–	1	–	–	–	–	–	–	2
Trichinella spiralis	3	–	–	–	–	–	–	–	–	–	1	2	6
Total	3	–	1	–	–	1	–	–	–	–	1	2	8
VIRAL													
Hepatitis A	–	–	1	1	–	–	–	–	–	1	–	–	3
Norwalk virus	–	–	–	–	–	2	–	1	–	–	–	–	3
Total	–	–	1	1	–	2	–	1	–	1	–	–	6
CONFIRMED TOTAL	16	4	16	11	20	16	22	15	21	16	12	12	181
UNKNOWN	22	14	31	28	36	35	18	23	24	20	16	19	286
TOTAL 1986	38	18	47	39	56	51	40	38	45	36	28	31	467

TABLE 20. Foodborne disease outbreaks, by etiologic agent and month of occurrence—United States, 1987

Etiologic Agent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
BACTERIAL													
B. cereus	–	–	–	–	–	–	–	2	–	–	–	–	2
Campylobacter	–	1	1	–	–	–	–	1	–	–	–	–	3
C. botulinum	1	3	–	–	–	–	1	–	–	1	–	5	11
C. perfringens	1	–	1	–	–	–	–	–	–	–	–	–	2
Salmonella	1	5	4	3	9	7	8	4	2	5	3	1	52
Shigella	–	–	–	–	2	–	6	1	–	–	–	–	9
S. aureus	–	–	–	–	–	–	–	–	–	1	–	–	1
Streptococcus, group A	–	–	–	–	–	–	–	–	1	–	–	–	1
V. parahemolyticus	–	–	–	–	–	–	1	–	1	–	–	–	2
Total	3	9	6	3	11	7	16	8	4	7	3	6	83
CHEMICAL													
Ciguatoxin	1	2	1	1	–	1	2	1	–	1	–	1	11
Heavy metals	–	–	–	1	–	–	–	–	–	1	–	–	2
Mushrooms	–	–	–	–	–	–	–	1	–	1	–	–	2
Scombrotoxin	–	–	2	1	1	3	6	2	4	–	2	1	22
Other chemical	–	–	–	–	1	–	–	–	1	–	–	–	2
Total	1	2	3	3	2	4	8	4	5	3	2	2	39
PARASITIC													
Trichinella spiralis	–	–	2	–	–	1	1	–	–	–	–	–	4
Total	–	–	2	–	–	1	1	–	–	–	–	–	4
VIRAL													
Hepatitis A	–	–	1	1	1	3	–	–	–	1	–	2	9
Norwalk virus	–	–	–	–	–	–	–	–	1	–	–	–	1
Total	–	–	1	1	1	3	–	–	1	1	–	2	10
CONFIRMED TOTAL	4	11	12	7	14	15	25	12	10	11	5	10	136
UNKNOWN	8	21	17	26	27	30	26	14	21	28	14	19	251
TOTAL 1987	12	32	29	33	41	45	51	26	31	39	19	29	387

Table 21. Foodborne disease outbreaks, by etiologic agent and contributing factors—United States, 1983

Etiologic agent	Number of reported outbreaks	Number of outbreaks in which factors reported	Improper holding temperatures	Inadequate cooking	Contaminated equipment	Food from unsafe source	Poor personal hygiene	Other
BACTERIAL								
Brucella	1	1	–	1	–	1	–	–
Campylobacter	8	6	1	–	1	5	–	1
C. botulinum	13	2	–	–	–	–	–	2
C. perfringens	5	5	5	4	1	1	1	–
E. coli	3	1	–	–	–	–	–	1
Salmonella	72	41	32	19	10	6	10	3
Shigella	7	3	1	–	–	–	2	–
S. aureus	14	11	11	–	5	–	3	–
Streptococcus, group A	1	1	1	–	–	–	1	–
Streptococcus, other	1	1	–	–	–	1	–	–
Other bacterial	2	2	1	–	–	–	–	2
Total	127	74	52	24	17	14	17	9
CHEMICAL								
Ciguatoxin	13	4	–	–	–	–	–	4
Heavy metals	4	4	–	–	–	–	–	4
Mushrooms	5	3	–	–	–	3	–	–
Scombrotoxin	13	4	2	–	–	2	–	1
Other chemical	10	6	1	–	–	1	–	6
Total	45	21	3	–	–	6	–	15
PARASITIC								
Trichinella spiralis	4	1	–	1	–	–	–	–
Total	4	1	–	1	–	–	–	–
VIRAL								
Hepatitis A	10	4	–	–	–	–	4	–
Norwalk virus	1	1	–	–	–	1	–	–
Total	11	5	–	–	–	1	4	–
CONFIRMED TOTAL	187	101	55	25	17	21	21	24
UNKNOWN	318	157	101	30	34	26	37	21
TOTAL 1983	505	258	156	55	51	47	58	45

Table 22. Foodborne disease outbreaks, by etiologic agent and contributing factors – United States, 1984

Etiologic agent	Number of reported outbreaks	Number of outbreaks in which factors reported	Improper holding temperatures	Inadequate cooking	Contaminated equipment	Food from unsafe source	Poor personal hygiene	Other
BACTERIAL								
B. cereus	3	3	3	–	–	–	–	–
Campylobacter	4	1	–	–	–	1	–	–
C. botulinum	11	0	–	–	–	–	–	–
C. perfringens	8	8	8	3	–	–	–	3
E. coli	2	1	–	–	–	–	–	1
Salmonella	78	57	44	14	27	1	31	5
Shigella	9	4	3	1	3	1	2	1
S. aureus	11	10	8	1	3	–	5	–
Streptococcus, group A	2	2	2	–	–	–	1	1
Total	128	86	68	19	33	3	39	11
CHEMICAL								
Ciguatoxin	18	7	1	–	–	6	–	–
Heavy metals	3	2	–	–	1	–	–	1
Monosodium glutamate	2	0	–	–	–	–	–	–
Mushrooms	2	1	–	–	–	1	–	–
Scombrotoxin	13	6	6	–	–	2	–	–
Other chemical	4	0	–	–	1	–	–	1
Total	42	18	7	–	2	9	–	2
PARASITIC								
Trichinella spiralis	11	1	1	1	–	–	–	–
Total	11	1	1	1	–	–	–	–
VIRAL								
Hepatitis A	2	1	–	–	–	–	1	–
Norwalk virus	1	1	–	–	–	–	1	–
Other viral	1	1	–	–	–	–	1	1
Total	4	3	–	–	–	–	3	1
CONFIRMED TOTAL	185	108	76	20	35	12	42	14
UNKNOWN	358	174	110	40	44	23	46	24
TOTAL 1984	543	282	186	60	79	35	88	38

Table 23. Foodborne disease outbreaks, by etiologic agent and contributing factors – United States, 1985

Etiologic agent	Number of reported outbreaks	Number of outbreaks in which factors reported	Improper holding temperatures	Inadequate cooking	Contaminated equipment	Food from unsafe source	Poor personal hygiene	Other
BACTERIAL								
B. cereus	7	6	5	–	3	–	2	–
Brucella	1	0	–	–	–	–	–	–
Campylobacter	9	7	1	2	1	2	2	–
C. botulinum	17	3	1	1	–	–	–	2
C. perfringens	6	4	3	3	2	–	2	–
E. coli	1	0	–	–	–	–	–	–
Salmonella	79	52	36	29	16	6	17	6
Shigella	6	4	1	–	–	–	4	–
S. aureus	14	8	8	–	2	–	5	2
Streptococcus, group A	1	1	1	–	–	–	1	–
V. cholerae	1	0	–	–	–	–	–	–
Other bacterial	1	1	–	–	–	1	–	–
Total	143	86	56	35	24	9	33	10
CHEMICAL								
Ciguatoxin	27	9	–	–	–	1	–	8
Heavy metals	3	2	–	–	–	–	–	2
Mushrooms	1	1	–	–	–	1	–	–
Scombrotoxin	15	7	5	–	–	1	–	1
Shellfish	2	1	–	–	–	1	–	–
Other chemical	10	6	–	–	–	–	–	6
Total	58	26	5	–	–	4	–	17
PARASITIC								
Giardia	1	0	–	–	–	–	–	–
Trichinella spiralis	8	2	–	–	1	1	–	–
Total	9	2	–	–	1	1	–	–
VIRAL								
Hepatitis A	5	4	1	–	–	–	3	1
Norwalk virus	4	2	–	1	–	1	1	1
Other viral	1	1	–	–	1	–	1	–
Total	10	7	1	1	1	1	5	2
CONFIRMED TOTAL	220	121	62	36	26	15	38	29
UNKNOWN	275	160	101	35	36	16	44	30
TOTAL 1985	495	281	163	71	62	31	82	59

Table 24. Foodborne disease outbreaks, by etiologic agent and contributing factors—United States, 1986

Etiologic agent	Number of reported outbreaks	Number of outbreaks in which factors reported	Improper holding temperatures	Inadequate cooking	Contaminated equipment	Food from unsafe source	Poor personal hygiene	Other
BACTERIAL								
B. cereus	4	2	2	1	–	–	–	–
Campylobacter	4	3	1	1	1	1	1	–
C. botulinum	22	1	–	1	–	–	–	1
C. perfringens	3	3	3	2	–	–	1	–
E. coli	1	1	–	1	–	–	–	–
Salmonella	61	38	25	14	17	3	13	5
Shigella	13	7	2	–	2	1	5	3
S. aureus	7	5	5	–	–	–	1	1
Streptococcus, group A	2	0	–	–	–	–	–	–
Streptococcus, other	1	0	–	–	–	–	–	–
V. parahemolyticus	1	0	–	–	–	–	–	–
Total	119	60	38	20	20	5	21	10
CHEMICAL								
Ciguatoxin	18	4	–	–	–	3	–	1
Heavy metals	1	1	–	–	1	–	–	–
Mushrooms	4	2	–	–	–	2	–	–
Scombrotoxin	20	9	7	–	–	2	1	2
Other chemical	5	2	–	–	–	–	–	2
Total	48	18	7	–	1	7	1	5
PARASITIC								
Giardia	2	1	–	–	–	–	1	–
Trichinella spiralis	6	1	–	1	–	–	–	–
Total	8	2	–	1	–	–	1	–
VIRAL								
Hepatitis A	3	2	–	–	–	–	2	–
Norwalk virus	3	3	2	–	1	–	2	1
Total	6	5	2	–	1	–	4	1
CONFIRMED TOTAL	181	85	47	21	22	12	27	16
UNKNOWN	286	138	107	21	34	8	36	29
TOTAL 1986	467	223	154	42	56	20	63	45

Table 25. Foodborne disease outbreaks, by etiologic agent and contributing factors — United States, 1987

Etiologic agent	Number of reported outbreaks	Number of outbreaks in which factors reported	Improper holding temperatures	Inadequate cooking	Contaminated equipment	Food from unsafe source	Poor personal hygiene	Other
BACTERIAL								
B. cereus	2	1	1	–	–	–	–	–
Campylobacter	3	0	–	–	–	–	–	–
C. botulinum	11	1	1	–	–	–	–	–
C. perfringens	2	2	2	1	1	–	–	–
Salmonella	52	32	20	16	9	2	9	6
Shigella	9	6	1	–	1	1	5	2
S. aureus	1	1	1	–	1	–	1	–
Streptococcus, group A	1	1	1	–	–	–	1	–
V. parahemolyticus	2	2	–	2	–	2	–	–
Total	83	46	27	19	12	5	16	8
CHEMICAL								
Ciguatoxin	11	3	1	–	–	–	–	2
Heavy metals	2	2	1	–	–	–	–	1
Mushrooms	2	0	–	–	–	–	–	–
Scombrotoxin	22	11	10	–	–	5	–	–
Other chemical	2	1	–	–	1	–	–	–
Total	39	17	12	–	1	5	–	3
PARASITIC								
Trichinella spiralis	4	0	–	–	–	–	–	–
Total	4	0	–	–	–	–	–	–
VIRAL								
Hepatitis A	9	3	–	–	–	–	3	–
Norwalk virus	1	1	–	–	–	1	–	–
Total	10	4	–	–	–	1	3	–
CONFIRMED TOTAL	136	67	39	19	13	11	19	11
UNKNOWN	251	146	94	18	25	6	41	48
TOTAL 1987	387	213	133	37	38	17	60	59

FIGURE 1. Outbreaks of foodborne disease, by state, 1983

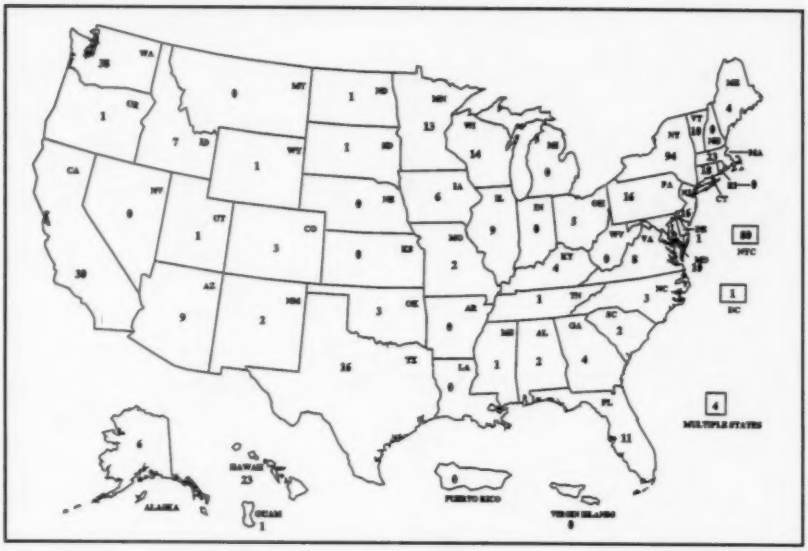


FIGURE 2. Outbreaks of foodborne disease, by state, 1984

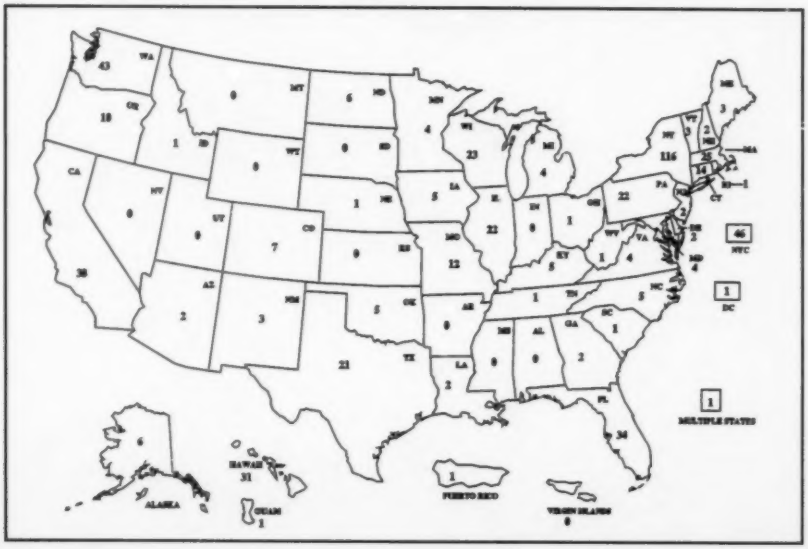


FIGURE 3. Outbreaks of foodborne disease, by state, 1985

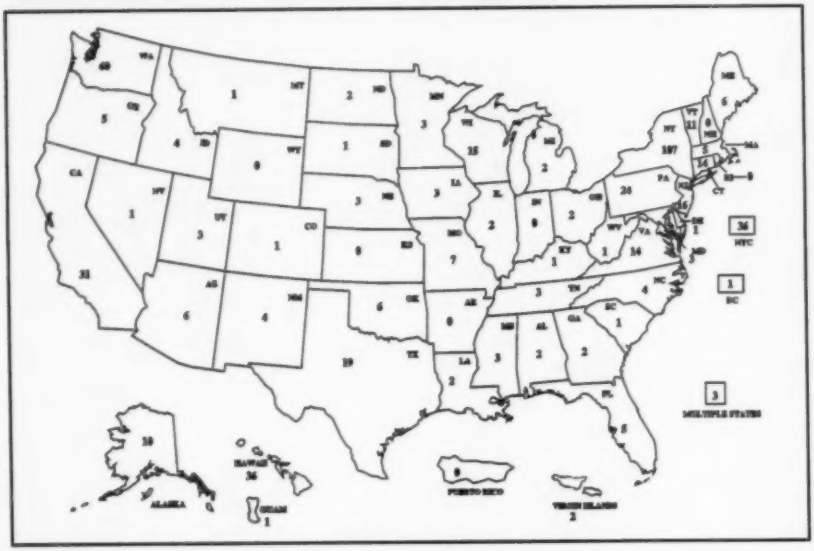


FIGURE 4. Outbreaks of foodborne disease, by state, 1986

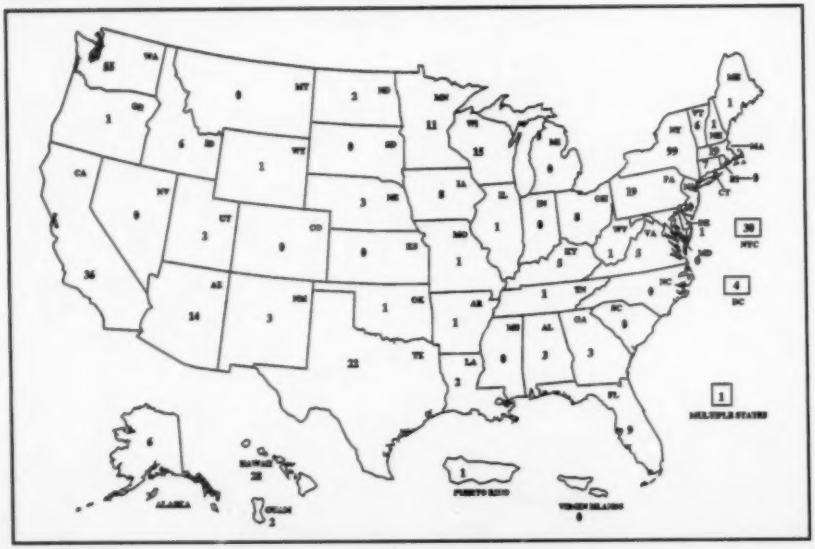
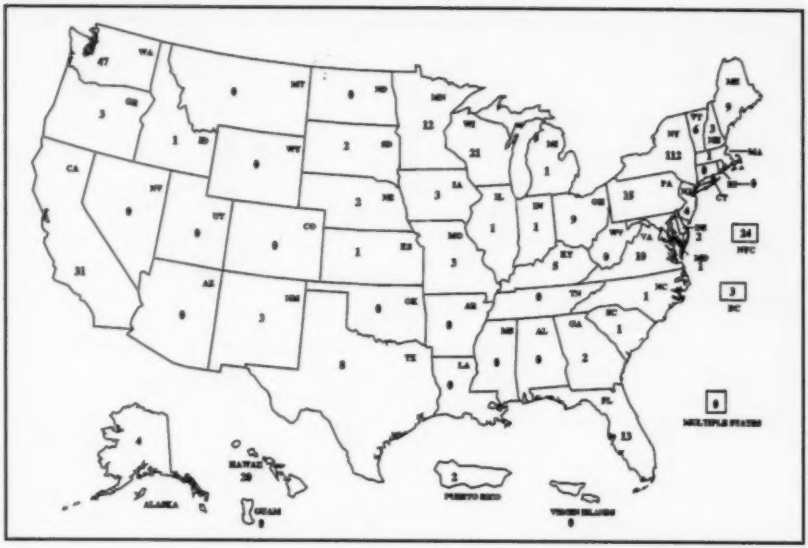


FIGURE 5. Outbreaks of foodborne disease, by state, 1987



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